ELECTRICAL REVIEW

and WESTERN ELECTRICIAN with which is consolidated ELECTROCRAFT

VOL. LXVI, No. 8. CHICAGO, SATURDAY, FEBRUARY 20, 1915. ISSUED WEEKLY

COMPRISING

ELECTRICAL REVIEW WESTERN ELECTRICIAN ELECTROCRAFT

ELECTRICAL REVIEW PUBLISHING COMPANY, INC.

608 SOUTH DEARBORN STREET
CHICAGO

Charles W. Price, President and Treasurer.
A. A. Gray, General Manager. H. S. Tuthill, Business Manager.
C. W. Forbrich, Assistant Business Manager.

E. E. Wood . . . . . 13 Park Row, New York, N. Y.
Manager Eastern States.
J. B. McCarthy . . . . . Detroit, Mich.
Manager Middle States.
C. W. Forbrich . . . . . Chicago, Ill.
Manager Western States.

ELECTRICAL REVIEW AND WESTERN ELECTRICIAN

Charles W. Price.....Editor-in-Chief
A. A. Gray.....Managing Editor
Morton Githens Lloyd.....Technical Editor
F. H. Bernhard.....Associate Editor
Howard Ehrlich .....Associate Editor

MEMBER THE SOCIETY FOR ELECTRICAL DEVELOPMENT DO IT ELECTRICALLY

SUBSCRIPTIONS.

One Year, United States $3.00
One Year, Canada 4.00
One Year, Foreign Countries 6.00
Single Copy, 10 cents. Back one month, each.. .25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

CONTENTS.

EDITORIALS:
The Control of Heating Circuits..... 325
The Opportunity of the Electrical Industry..... 326
Central-Station Ice-Making 326
Co-Operation of Contractor in Securing New Business ... 327
DEPARTMENTS:
Commercial Practice 332
Electric Sign Data..... 336
Electrical Construction 337
Public Service Commissions..... 343
New Electrical and Mechanical Appliances..... 355
Current Electrical News..... 361
Record of Electrical Patents..... 365
LEADING ARTICLES:
Electricity in an Automobile Assembling Plant..... 329
Proposed Changes in the Code to Be Considered by Electrical Committee 337
Electrical Engineering Problems.—By R. G. Hudson and W. V. Lyon 344
Selection and Application of Motors.—By Gordon Fox... 348
The Outlook in the Electrical Industry..... 351
LETTER TO THE EDITOR:
One of the Hazards of Concentric Wire.—By C. W. Abbott 353
The Proposed System of Wiring.—By R. B. Benjamin.... 354
MISCELLANEOUS:
Electrical Exports for December and the Year 1914..... 328
Present Necessity for Economy in Manufacturing Opportunity for Central Stations, as Evidenced By Lehigh Contracts 332
New Park Lighting System for Louisville..... 332
Statistics on Business of United Electric Light & Power Company 333
New-Business Plans of Rockford Company..... 334
Many Possibilities of Electric Heating and Cooking Brought Out in Meeting of British Central Stations.. 334
Ice-Making by Central Stations Not Recommended in Massachusetts 335
Spectacular Theater Sign in Cincinnati..... 336
Brooklyn Contractors Guests of Edison Electric Illuminating Company at Annual Dinner..... 340
Electricians' Licensing Bill Presented in Massachusetts.. 340
Why Jones Went Broke..... 341
One Method of Locating Faults in an Armature.—By P. M. Blough..... 342
Massachusetts Hearing on Rates..... 347
Thomas A. Edison's Sixty-eighth Birthday..... 352
Storage Batteries for Radio Service..... 352

Copyright, 1915, by the Electrical Review Publishing Company, Inc.

THE CONTROL OF HEATING CIRCUITS.

It is generally the case and is generally recognized that the use of electrical energy for heating is not commercially practicable where energy is sold at the rates customary for lighting purposes. Since the characteristics of a heating load are such as to entitle it to lower rates than in the case of energy used for lighting, such rates are usually offered by central stations. Where a special rate is offered for this purpose, it is necessary to meter the energy separately and it is sometimes necessary to insure that energy supplied on such circuits will not be used for other purposes, such as lighting.

The use of a flat-rate controller in which the circuit is interrupted when the current exceeds a stated value is well known. One form of such controller causes the circuit to be intermittently interrupted, so that the flashing of the lamps on such circuit make their use intolerable. In the case of electric heating such interruptions are of no consequence, since it is the time integral of the transformed energy which is of importance. Such a device, consequently, does not hinder the use of the current for heating purposes, provided the interruptions do not cover an important fraction of the total time.

This idea has been utilized by Professor Arno in Italy in a device intended for heating circuits in which the current is interrupted for two seconds at intervals of twenty seconds, thus making the use of lamps upon such a circuit impracticable. The energy consumed by the operating mechanism is itself insignificant and the short time of the break has but small influence upon the use of the current for heating purposes.

The invention of such a device was called forth by the peculiar system of taxation in Italy, which affects differently the use of electrical energy for the two purposes. Cases will frequently arise in this country, however, where the use of such a device would also be found advantageous.

But the reverse problem arises in flat-rate control. A controller which merely flickers the lamps will not prevent the use of heating devices which utilize more energy than is contemplated when the flat rate is contracted for. This problem has also been met and a device is now on the market which continuously limits the current to an ineffective value in case, for example, a sad iron is connected to a circuit intended to use only 200 watts.

Human ingenuity can meet any problem of this character. The practical questions usually are: Is the value of the device equal to its cost? Is it simple enough to make operating trouble unlikely?

THE OPPORTUNITY OF THE ELECTRICAL INDUSTRY.

In every industry the business leaders are realizing that an emergency exists. Methods and policies are changing. The overworked word "efficiency" which rolled so smoothly from the tongues of many for several years, has come to have a new meaning. We all know that intensified production and efficiency in the shop and in the office have been, to a great degree, matters of a conversational character. Today men are more than ever earnestly seeking better ways of doing business, and it is a part of every business man's creed that it is along the lines of intensified production and increased efficiency of operative movements that increased profits lie. Business men are planning ways and means today that either because of conservatism or fear would have received but scant consideration only a short time ago. The dearth of raw materials forced upon us by the European war, which has deprived us of easy and economical access to many things regarded as indispensable in the fabrication of many materials, has quickened the impulse of the American inventor and manufacturer, and new industries are springing up where it has heretofore been considered impossible to make a safe investment, to say nothing of gaining a decent livelihood. The necessity for quickly establishing new industrial relations and a better understanding of manufacturers in general of the economy and refinement of control of electrical energy, are attracting the brightest minds of aggressive manufacturers in every line of commercial activity to the use of electrical apparatus.

The reports of central-station companies in every part of the country indicate a growing appreciation of the use of industrial electrical appliances. The manufacturers of electrical apparatus have been quick to respond to the demand made upon them, and there is now cataloged standard apparatus which may perform, through the utilization of electrical energy, practically every service that we know of today in industry.

The present crisis is the opportunity of the electrical industry. As our factories become busier and busier there will be a greater demand for motor-driven apparatus, for other industrial electrical appliances, and as the busy plants work up to their normal capacity the greater will become the demand for controlled power. As the necessity for night work comes on the desirability of the use of electricity as a medium of illumination will become more and more apparent. Any material prosperity which may come to other industries means a tenfold increase in the prosperity of those having to do with the generation of electrical energy and the manufacture and distribution of industrial electrical appliances. Unlike in former times of prosperity, electricity is no new thing; it has been tried out. The manufacturer in every industry is sold. It remains then for the central-station interests of the country to vigorously prosecute selling campaigns, to educate further the manufacturers in other lines to the desirability and efficacy of the use of this controlled power; for the manufacturer of electrical apparatus to be still more on the alert to meet the demands for standard and new applications, and for the salesman and contractor to educate themselves with regard to the characteristics of the apparatus they are selling or installing and its possibilities in doing the work of the industrial world.

CENTRAL-STATION ICE-MAKING.

Of more than passing interest is the announcement, elsewhere in this issue, that a special Commission, appointed by the Massachusetts legislature to investigate the desirability of permitting central stations to manufacture ice, had recommended against this practice. The Commission is reported as saying that, "There are other businesses that are more feasible for central stations to take up as a side issue than ice-making, which has the disadvantage of involving long periods of idleness of apparatus during the winter seasons. To enter this field might raise the issue of entering other lines of activity of various nature, and this would complicate the effective supervision and regulation of lighting and power companies by the State Commission."

A careful study of the question of ice-making as an adjunct to the central-station business indicates results that are entirely opposite to the observations of the Massachusetts Commission. There are small central stations in all parts of the country that have found it imperative to enter the ice-making business in order to earn a reasonable return on the capital invested in the enterprise, and, as the winter peak loads of central stations increase with the continual addition of residence and commercial lighting, the advantages of the ice adjunct will become more and more pronounced. Ice-making as a side issue for central stations is not a new idea, but it is only within comparatively recent times that any prominence has been given to this subject.

A single investment for real estate, buildings and steam power plant is all that is necessary for both departments, and in many instances it is possible to house the ice-making equipment under the same roof with the electrical departments, and also to utilize the services of the same engineers and firemen. By this means, considerable reductions can be made in the operating expenses, and a greater margin of profit left than would ever be possible with either plant running singly.

As to natural ice, it is expensive both to store and transport. Manufactured ice, while perhaps no better than the best natural ice, runs much more uniformly and is of considerably better grade. Moreover, with artificial ice, the water can be distilled or sterilized before freezing, so as to remove the dangers found to exist in the natural product. These features, it will be seen, favor artificial ice, irrespective of cost, but it is also true that the average cost of manufactured ice, where cheap energy is available, is, if anything, rather less than the cost of the natural ice plus storage and distribution charges. Contrary to the opinion of the

Massachusetts Commission, artificial ice plants are not nearly so restricted in geographical distribution by climatic range or the competition of natural ice as is generally believed.

A majority of the central stations operating ice-making equipment have either provided storage facilities where ice can be stored during the early spring and summer for use during the time of greatest demand, or sell their entire ice output to distributing or sales companies which usually have such storage space. Thus the statement of the Commission that the business has the disadvantage of long periods of idleness of apparatus during the winter season seems groundless. This is particularly true where the company has an appreciable winter business, which is no longer uncommon.

From the standpoint of supervision and regulation by state commission, it is difficult to see how the situation in Massachusetts would differ from that in many other states with regulatory bodies where ice-making is conducted by central stations. Apparently no conditions involving the combination plants have arisen that have complicated the problems of effective regulation.

In one section of its report the Commission admits that, "In the warmer parts of the country the lighting company is the natural and logical producer of manufactured ice." This statement is made because of conditions of demand and supply peculiar to the warmer localities, and not because of engineering or physical considerations. It certainly seems, therefore, that the same line of reasoning should be applied in Massachusetts. Local conditions as to market for ice, equipment available for ice-making that is regularly idle in summer, water supply, etc., should govern the question of whether or not to engage in the business, but certainly no state law prohibiting this practice should be passed.

Concerted action on the part of those interested in this subject in Massachusetts should be taken to prevent the passage of a law so reactionary, and that will establish a precedent that may work great hardship on utility companies.

CO-OPERATION OF CONTRACTORS IN SECURING NEW BUSINESS.

The progressive central station of today has a commercial department which has become a valuable and important part of the organization The commercial manager is of necessity a man of education and ability, who recognizes the importance of co-operation in present-day business, and has, at least within comparatively recent times, extended his every effort to secure harmonious relations, not only with the public, but with the electrical contractors and dealers in the territory served by the company. It has only been a short time, however, since the contractor made no effort to give to the public the service which came legitimately within the scope of his business, yet complained if the utility company encroached upon this field. Little or no attention was paid to retail stores, and the sale of fixtures, electric fans in their season, and commodities regularly used by the trade were all that he had to offer.

The advent of the many electrical necessities for domestic use, however, has brought increased patronage, and today the large variety of heating and other current-consuming devices gives the contractor a greater opportunity and incentive to establish a retail trade. On the other hand, progressive central-station companies are convinced that it is for their best interests to co-operate rather than attempt to control or monopolize the sale of appliances by selling at cost or less and to leave the matter of wiring entirely in the hands of the contractor.

In many localities this policy has been consistently employed by the central station, and various methods for turning over to the contractors the wiring jobs that were originated by the central-station salesmen have been employed. The city of Rockford, Ill., is in the latter class and now announces plans for the current year which indicates a still further development in the effort to work in complete harmony with the contractor. As reported elsewhere in this issue, the central station will employ five additional house-wiring salesmen, whose commissions will be paid by the five electrical contractors of the city. This will enable the company to increase its sales organization to a point where an extensive campaign for new business can be carried on at an expense no greater than under previous conditions. The contractors, on the other hand, will be securing the services of five competent men and will pay commissions only on work which they actually obtain.

It is also gratifying to note that a co-operative advertising fund has been created in Rockford, to which fund each contractor has agreed to contribute a stipulated sum each month. This is certainly a step in the right direction and should result in the acquisition of much new business.

It seems that the co-operation, which has reached such a high state in Rockford, could well be carried a step further and include the architect and prospective builder. The average architect is far behind the times as regards electrical wiring, and usually does not give the wiring problem the attention that it deserves. By co-operating with the architect and builder, the central station and contractor would insure the proper location and an adequate number of outlets.

One of the crying needs in the electrical industry, that has developed as a result of the wide use of domestic appliances, is properly located outlets so that dining room and kitchen equipment can be conveniently used and so that portable lamps can be employed without stringing wires from a central ceiling fixture as is now necessary in many of the older buildings. Much improvement in lighting conditions could also be effected by the proper co-operation between the various interests. Here is where the central-station salesman and the contractor may work hand in hand.

The Manufacture of Rubber-Covered Wire.

Henry A. Morss, vice-president of the Simplex Wire & Cable Company, delivered a very interesting address before the Chicago Jovian League on February 15, entitled "The Manufacture of Rubber-Covered Wire." By means of stereopticon views Mr. Morss traced the development of the bare wire to the finished stages, and illustrated the operation of the various machines involved by means of moving pictures.

The wire to be covered is first coated with a thin layer of tin, which is to protect the wire from the sulphur contained in the rubber. The various rubber working processes were described. Crude rubber is received in the form of biscuits of various sizes, and these are masticated and thoroughly washed to remove foreign substances, and after cooking the rubber is run through calenders, coming from these machines in the shape of homogenous sheets.

Methods of stranding were described, and the operations of coating the wire with rubber insulation and cotton shown.

Elaborate testing facilities are provided for insulation and voltage tests, and in this work special machines have to be employed. In voltage tests a direct-reading voltmeter is employed to show the peak voltage applied to wire under test.

Jovians Guests of Ohio University.

Fifty Columbus (O.) Jovians were the guests of the several electrical departments of the Ohio State University, of that city, February 12. The affair began with a six o'clock dinner at Ohio Union, the general club house of the university. Tribune C. J. Metz acted as toastmaster.

A most interesting talk was given by Thomas E. Green, telephone expert of the Ohio Public Utilities Commission. Some ten or twelve years ago, when Sir Thomas Lipton sailed into New York Harbor on his yacht Erin, which accompanied the Shamrock, contestant in the America Cup races, the event was notable in an electric way, because the Erin carried the first wireless apparatus that had ever come into that port as part of a vessel equipment. It was of the DeForrest system. Mr. Green, who was in the service of the Western Union in New York at that time, expected to go into the wireless field, and spent several days at the time of the Erin's arrival in handling the De Forrest apparatus. This experience formed the basis of his talk.

On a tour of the electrical branches of the university the Jovians were given a number of demonstrations. At 9 o'clock they heard the official arrival by wireless of the time at the National Observatory, Washington, D. C. They also witnessed the operation of the oscellagraph, an apparatus for showing visibly current and voltage waves on electric wires by means of mirrors, and were shown some unique experiments in high-frequency current. The Jovian Order is well represented at the university through some of its professors.

Philadelphia Section Activities.

The January meeting of The Philadelphia Electric Company Section, National Electric Light Association, was Ladies' Night, and was held on Tuesday evening, January 19, in Lu Lu Temple, Philadelphia. After a musical program, Francis Harvey Greene, professor of the West Chester Normal School, spoke upon "The Nature and Worth of Wit and Humor." De Mar, the noted cartoonist of the *Philadelphia Record*, gave some demonstrations of his facility with the use of crayons. Other entertainment features followed.

Approximately 1,400 persons were in attendance.

The combination meeting of the Engineering and Commercial Department Branches of the Section was held in the Auditorium of the Meter Department, on Tuesday evening, January 5. H. Carl Albrecht presided. The meeting was opened with several selections by the Norristown Mandolin Club. R. B. Ely, of the Commercial Branch, gave an abstract of the Illuminating Section of the "Electrical Salesmen's Handbook." P. H. Bartlett gave a very interesting talk upon the Stannos method of house wiring. James T. Maxwell, the Company's general agent, presented prizes aggregating $35 to W. H. Wohnus, Horace Nusbaum and John R. Keenan, all solicitors of the Company. In the spring of 1914, being convinced that solicitors could do much toward introducing the appliances on the system, Mr. Maxwell tried a personal experiment by offering three prizes, one for $15, and two of $10, to the solicitors who obtained the best results along these lines. Much activity was stimulated among the solicitors generally. The total number of appliances placed upon the system as a result of these prizes being offered, was 274 in the year 1914, representing a sale value of about $4,500. A rising vote of thanks was extended to Mr. Maxwell for the prizes. The chairman of the meeting then introduced Harold C. Goodwin, Jr., winner of the Doherty Medal last year, who spoke upon some distribution problems. After a few remarks by C. J. Russell, the meeting was adjourned.

The combination meeting of the Accounting Department Branch and the Meter Department Branch was held in the Auditorium of the Meter Department on January 12. The speaker of the evening was Harold Earle Cook, lieutenant commander in the United States Navy.

Electrical Exports for December and for the Year 1914.

The report of the Bureau of Foreign and Domestic Commerce, covering the foreign commerce of the United States for last December, and also for the calendar year 1914, has been published. From this are taken the following data respecting the electrical exports for the two periods named:

The December electrical total was slightly below that of the preceding month, and, of course, still much below that of the corresponding month in 1913. For the four classes for which the number of articles shipped is given in the government reports, there were exported in December the following: Electric fans, 693; arc lamps, 52; carbon-filament lamps, 34,856; metal-filament lamps, 383,545.

In the following table are given the detailed figures for the several classes for last December, and for the corresponding month of the preceding year:

Articles.	Dec. 1914.	Dec. 1913.
Batteries	$ 58,947	$ 45,928
Dynamos or generators.	262,325	181,407
Fans	13,784	19,012
Insulated wire and cables	92,146	190,090
Interior wiring supplies, etc. (including fixtures)	54,836	52,125
Lamps—		
Arc	742	2,776
Carbon-filament	3,962	14,785
Metal-filament	64,058	21,267
Meters and other measuring instruments	21,200	.....
Motors	271,192	376,122
Static transformers	62,097	134,213
Telegraph instruments (including wireless apparatus)	2,118	31,999
Telephones	113,627	159,030
All other	599,529	1,005,245
Total	$1,620,563	$2,233,999

The following table gives the monthly totals for the year 1914. This shows that early in the year already there was a decline month by month from the high totals of 1913, which became most marked, however, in August, the first month of the war.

Months, 1914.	Electrical Exports
January	$1,947,646
February	1,930,513
March	2,104,332
April	1,741,551
May	2,040,720
June	1,450,437
July	1,415,360
August	1,024,010
September	1,548,468
October	1,494,792
November	1,644,723
December	1,620,563

In the following table are given the annual totals for the years following 1908, when the last general export depression reached its lowest point:

Years.	Electrical Exports.
1908	$12,613,730
1909	13,027,550
1910	17,001,126
1911	19,355,536
1912	23,212,813
1913	28,197,363
1914	19,963,115

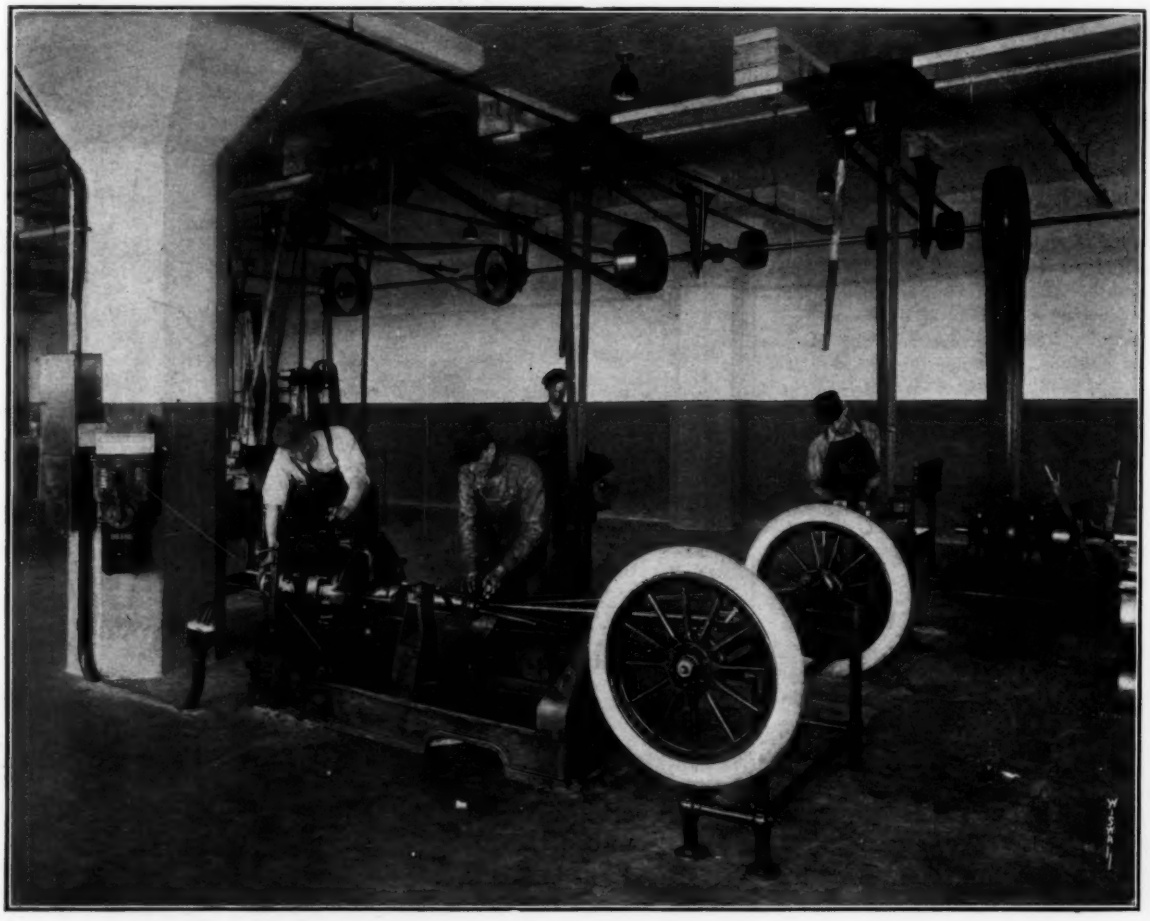
The longest electric power transmission line in service is between Bishop and El Centro, Cal., a distance of over 400 miles.

Electricity in an Automobile Assembling Plant.

This article describes the electric motor equipment in a plant devoted to automobile assembling in Denver. The installation is similar in every respect to other assembling plants contemplated in various localities, and to those already in service in various cities of the country. The Denver plant is the most recent one erected.

A new assembling plant has recently been completed in Denver by the Ford Motor Company. The building covers a ground area of 129 feet by 172 feet, four stories and a basement and is built of the Cantilever flat-slab system of reinforced concrete. Each floor has its outside surfaces almost entirely of glass excepting the room necessary for sills and concrete construction.

This building was constructed with the aid of electric drive, using a five-horsepower motor for brick hoist, 7.5 horsepower for a timber hoist, two 15-horsepower motors connected to concrete hoists and two 10-horsepower motors driving concrete mixers, one being half cubic yard concrete mixer (Chicago) and the other a Cropp mixer of 22 cubic feet capacity. The total concrete used in the structure was approximately 5,000 cubic yards.



A 20-Horsepower Motor Driving a Machine for Limbering Up the Engines and Bearings—Ford Motor Company, Denver.

Throughout the building there are 700 48-candlepower tungsten lamps used, and although glass is on all four sides of the building, at each floor lights are kept burning all day in the central part of each floor and also in the basement, while during cloudy days and late in the afternoons during winter months, all of the lights are liable to constant use.

Forty cars of automobile parts to be assembled were recently received at the Denver plant and were unloaded from the cars at the first floor or upon the platform where they were conveyed to the basement and from these floors distributed to the upper stories by means of an elevator driven by a 25-horsepower motor.

In the basement, the work of assembling the chassis, fenders, etc., is carried on. A five-horsepower motor running at 1,700 revolutions per minute is direct-connected to a four-inch centrifugal pump made by the Lawrence Manufacturing Company which circulates the hot water for heating the building. A 20-horsepower motor running 860 revolutions per minute drives a 6 by 8 Bury air compressor. The compressed air is used for inflation of tires and for operating various pneumatic tools in the machine shop. A five-horsepower motor running at 1,700 revolutions per minute operates a punch press which is used for riveting braces for the fenders and other parts about the body. This application is shown in one of the accompanying illustrations.

On the first floor is a five-horsepower motor running at 1,130 revolutions per minute, driving a wheel

painting machine. This machine consists of a 30-gallon steel tank in which is a vertical shaft and to which, at the lower end, the automobile wheels are connected one at a time. It is adjustable so that it may be lowered into the paint, dipping the wheel and being elevated in the tank. After being brought up to speed, the centrifugal force spreads the paint evenly over the wheel and deposits any surplus against the inside surface of the tank. This is shown in one of the accompanying illustrations.

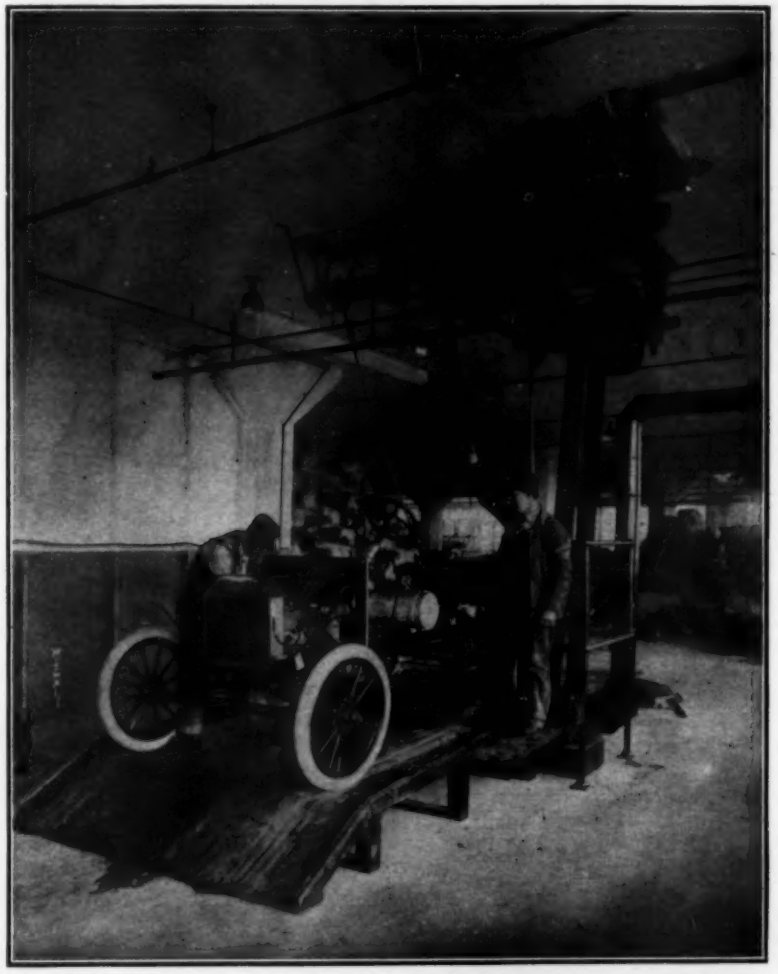
On the second floor is a two-horsepower motor running at 1,130 revolutions per minute, driving a Ford magneto used for testing spark coils. A 20-horsepower motor of 850 revolutions per minute drives the following machines in the machine shop: A lathe, drill press, boring mill, emery wheel and a machine for "burning" in the bearings of the car wheels. After the wheels have been finished at the factory, they are placed on their bearings in the assembling plant and adjusted to position. They are then turned in this condition until worn smooth. A 20-horsepower motor, 750 revolutions per minute, drives a machine for limbering up the Ford gasoline engines, adjusting the differential, etc. These machines are driven at their rated speed. An ammeter is placed in the circuit supplying electric current to the motor and the engines are operated in this manner until the current indicated by the ammeter has decreased to a minimum, showing that the bearings are thoroughly polished and free and easy to run. The same motor is used for driving and testing the gasoline engines and for testing the adjustments, oil circulation, etc. A five-horsepower motor running at 1,100 revolutions per minute drives a band saw used for the making of crates, boxes, etc., necessary for shipment.

On the third floor are assembled the steering gears, mufflers, fenders, and the bodies. On this floor is a 7.5-horsepower motor running at 855 revolutions per minute, driving a starting machine. This machine, shown in one of the illustrations, consists of two shafts placed on a platform two feet high with sloping runways, and sheave wheels are so placed and adjusted that after the car is run upon this platform, the hind wheels fit into the grooves of the sheave wheels so that each wheel fits a corresponding sheave wheel on each of the two shafts. When these sheave wheels are therefore brought up to speed, they drive the engine and turn it over, in this way acting as a starter for starting up the machine. The machine is then run upon the elevator and taken upon the roof where it is driven upon the testing course for final testing and adjusting purposes.

On the fourth floor is done the upholstering, finishing and painting of the hoods, fenders and all metallic parts. These are dipped in a special paint-treating tank and then suspended in two japanning ovens, each 9 by 18 feet. These use a consumption of 1,500 cubic feet of artificial gas per hour, allowing a variable temperature depending upon the pieces to be treated, ranging from 680 degrees, Fahrenheit maximum to whatever lower temperature is required.

The factory has a capacity of 30 complete cars per day and all electric current and gas is supplied by the Denver Gas and Electric Light Company.

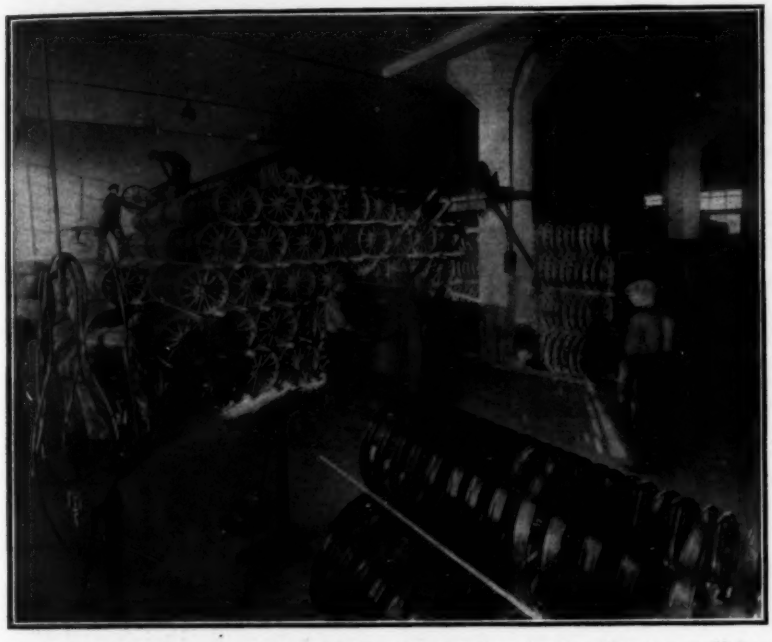
The roof has been specially built for testing purposes of all the Ford motor cars. This roof has a parapet of from three to ten feet above the surface of the roof, depending upon what part of the slope is observed. After the regular horizontal concrete floor roofing was installed, cinders were placed in such condition as to give the necessary slope for drainage. After this a layer of concrete was placed and above this a five-ply felt and tar roofing. Two inches of cement mortar were then covered over all and 6 by 9-inch roof tiling one inch thick made by the Hinds Roofing Tile Company of Denver was set in the mortar, completing a very smooth surface and providing an ideal floor for driving and testing the cars.



Machine for Starting Engines, Driven by a 7.5-Horsepower Motor, Ford Motor Company, Denver.

The total connected horsepower installed at the Ford assembling plant at Denver aggregates 127, this representing the installation of 14 separate motors. The maximum energy consumption for any one month occurred in April when the kilowatt-hour reading was 5,130. The average consumption per day is 197 kilowatt-hours, exclusive of lighting.

The plant operates nine hours per day, six days per week and the average kilowatt-hours per month per connected horsepower is 43.8. The maximum monthly operating-time load-factor is 23 per cent and the average load-factor is 7.5 per cent.

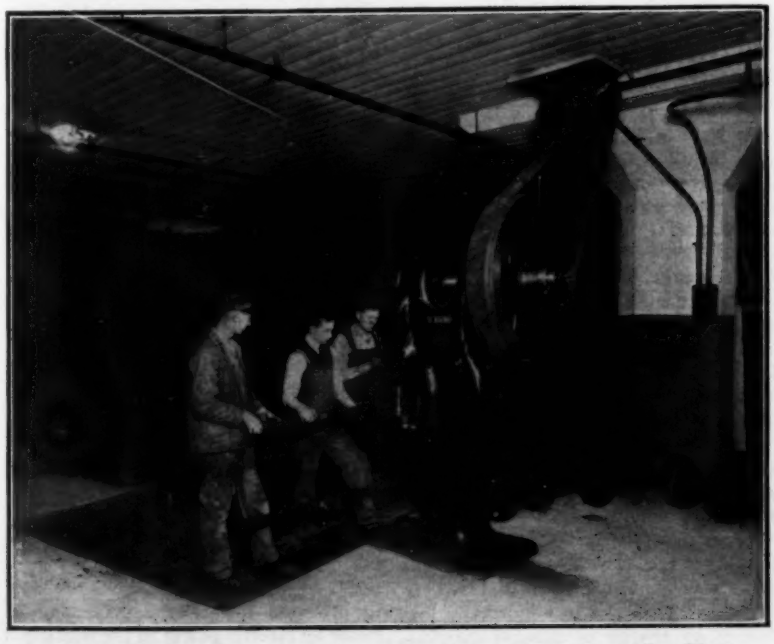


Wheel-Painting Machine in Ford Assembling Plant Driven by Five-Horsepower Motor.

The following is the lighting consumption during 1914, using 700 60-watt lamps: January, 3,580; February, 3,640; March, 3,290; April, 4,700; May, 3,590; June, 3,530; July, 3,350; August, 3,549; September, 3,760; October, 4,240; November 4,930; December, 5,830.

The accompanying table gives a list of the motors installed with their respective drives. Energy is supplied by the Denver Gas & Electric Light Company at three-phase, 220 volts.

No.	Horsepower.	Application.
1	5	Driving a four-inch centrifugal pump for circulating hot water in heating system.
1	20	Driving an 8 by 8-inch Berry air compressor for supplying pneumatic tools; and for inflating tires.
1	5	Belted direct to punch press.
1	5	Driving wheel-painting machine.
1	2	Driving Ford magneto-testing machine.
1	20	Driving line shafting which operates one Reed 18-inch lathe; two Reed 16-inch drill presses; one 16-inch shaper; one four-inch pressing machine for reaming cylinders of the engines; one hack saw; and one 12-inch emery wheel.
1	20	Driving limbering-up machine.
1	7.5	Driving starting machine.
1	1	Driving exhaust fan.
1	5	Driving six-inch blower.
1	2	Driving centrifugal pump for circulating hot water for the enameling tank.
1	25	Driving freight - elevator mechanism.



Punch Press Driven by a Five-Horsepower Motor at Ford Assembling Plant.

The Union Gas & Electric Company Forms Company Section, N. E. L. A.

The Union Gas & Electric Company Section of the National Electric Light Association was formed at a meeting of the officials and employees held at the offices of the company on Thursday evening, February 4.

This meeting, which was a very enthusiastic one, was addressed by T. C. Martin, secretary of the N. E. L. A., who gave a very interesting talk on Company Section work as reviewed by him in an extensive trip he had just completed, which included a visit to the Pacific Coast. W. W. Freeman, president of the Union Gas & Electric Company and past president of the N. E. L. A., presided at the meeting and gave a talk on the scope of the work of the Association and the purpose of Company Sections. A report was made by T. F. Kelly, chairman of the Ohio Membership Committee, of the N. E. L. A., on the formation of the Company Section at Dayton on the preceding evening.

The following officers were elected: Chairman, F. R. Healey; vice-chairman, Fred E. Schornstem; secretary, W. A. Wadsworth; treasurer, W. L. Krohme.

Announcement was made by the chairman of the Program Committee which would indicate that the section will become very active, as arrangements which have already been perfected will make it necessary to hold special meetings aside from the regular monthly meetings, which will occur the first Thursday of each month.

One hundred and twenty-one applications for membership were received and this number is expected to be added to very materially, and there is every reason to believe that this company Section will become one of the most enthusiastic.

Electrical and Mechanical Features of Panama Canal to be Described by Mr. Schildhauer.

At a joint meeting of the Chicago Section, American Institute of Electrical Engineers, and the Electrical Section, Western Society of Engineers, to be held in the latter society's rooms, Monadnock Block, Chicago, on the evening of February 23, Edward Schildhauer, mechanical and electrical engineer of the Panama Canal, will present a paper touching on "Features of the Mechanical and Electrical Installation, Panama Canal.

Commercial Practice
Management, Rates, New Business

Present Necessity for Economy in Manufacturing Opportunity for Central Stations, as Evidenced by Lehigh Contracts.

The Lehigh Valley Light and Power Company of Allentown, Pa., has good reason to believe that the advance guard of renewed prosperity has arrived in spite of the depressing industrial conditions suffered by this country in its role as the innocent bystander of the great European conflict. This is evidenced by the contracts for central-station energy signed up recently. Among the larger loads added to this company's lines recently are the following:

The Traylor Engineering & Manufacturing Company, which is erecting a large new addition to its plant in order to fulfill a $10,000,000 order for automobile axles. The contract calls for 500 horsepower in power and lighting. The power demand will be taken by 25 motors and it is planned to displace the 80-horsepower isolated plant as soon as conditions become favorable for its disposal.

The Bryden Horse Shoe Company of Catasauqua, Pa., which is working on a large order to supply horseshoes to some of the countries now engaged in the European struggle. The initial contract called for 80 horsepower to relieve the company's isolated plant of most of its wasteful labors but an additional 50 horsepower has since been connected up.

One of the greatest factors contributing to the success of the Lehigh Valley Light & Power Company in its relentless war on the money-burning isolated plant is its exceedingly equitable schedule of power rates scientifically designed to cover all conditions of industrial operation to the mutual advantage of the consumer and the central station.

New Park Lighting System for Louisville.

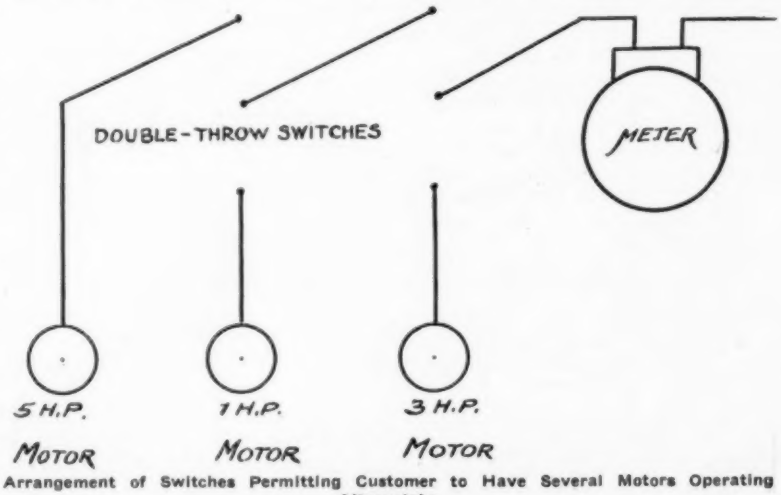
Two hundred and fifty electric light standards are to be installed by the Louisville (Ky.) Gas & Electric Company in the city parks and along the parkways, replacing some 215 gasoline lamps, which have been doing duty, according to the terms of a contract just closed between the company and the Board of Park Commissioners. The contract, renewable annually, is to run for a period of 10 years, and provides that each lamp, to be owned, installed and maintained by the lighting company, shall be paid for at the rate of $35 a year. The system will replace practicaly every gasoline lamp in the park system, and burn all the year around, whereas the gasoline lamps have burned only in the summer months.

Negotiations between the Board and the lighting company were expedited in the interests of the labor situation, and a large number of men will be given work at once digging the trenches and installing the apparatus. The standards, of cast iron, corrugated, will stand 200 feet apart on alternate sides of the streets, and will be fed through an underground armored steel cable. The trenches, which must be dug, will total eight miles in length. The standards, similar to 77 which the company installed some time ago on Eastern Parkway, will be topped by an oval globe, which will contain a 100-watt nitrogen-filled lamp. The standards already in use have been giving excellent service. The contract was halted for a time while the park commission investigated conditions in other cities, finding that the rates prevailing in Louisvile are favorable to those enjoyed elsewhere, except in cases where they have been put to abnormally low figures by reason of ruinous competition.

Unique Arrangement of Switches for Motor Service.

An interesting arrangement of switches, whereby a customer is enabled to have as many motors as he desires to purchase, and yet his connected load is limited to the size of the largest motor, has been worked out by a utility in the Middle West in connection with rural service.

The scheme consists of a number of double-throw knife switches, connected as shown in the accompanying sketch, in which, for clearness the two or three wires (as the case may be) are indicated by a single line.



Arrangement of Switches Permitting Customer to Have Several Motors Operating Alternately.

A brief inspection of this sketch will show that it is impossible to operate more than one motor at a time, and an arrangement like this might be used to advantage in many city power installations.

Street Lighting for Mankato.

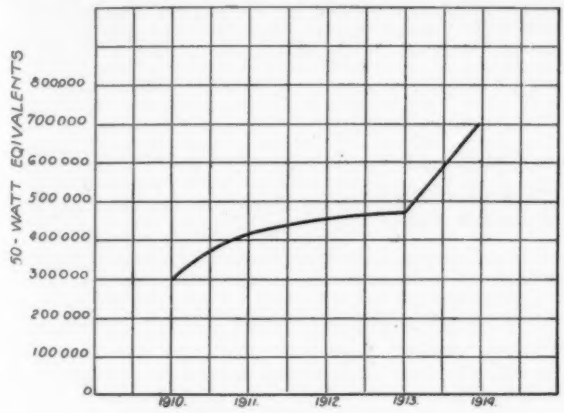
The city council of Mankato, Minn., has awarded a six-year street-lighting contract to the Consumers Power Company, the price per arc lamp being fixed at $60 per annum. Provisions are also made for the supplying of current for an ornamental lighting system in the business district, which the city proposes to install. Negotiations are now in progress toward the displacing of steam by electric power in the municipal water works.

Statistics on Business of United Electric Light & Power Company.

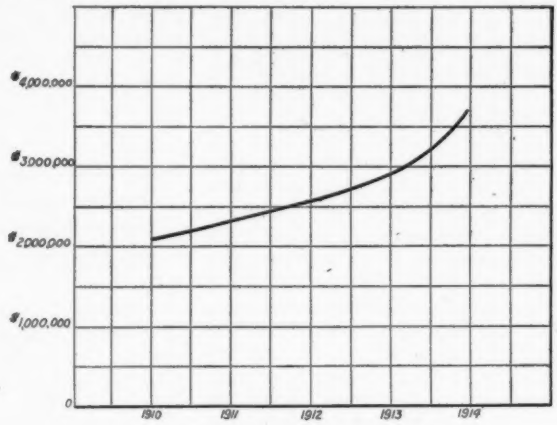
At a recent meeting of the Association of Employees of the United Electric Light & Power Company, New York City, Joseph F. Becker, sales manager of the company, outlined to the employees and the members of the Association the activities of the sales department during the year 1914.

Mr. Becker showed some very interesting slides, giving the total kilowatt-hours sold, together with the revenue of the company for the past five years. In addition, a number of slides showing the larger propositions secured by the building that had been erected on Broadway during the year 1914.

The accompanying illustrations show the development of the company's business during the period from 1910 to the end of 1914. The curve showing new business connected during this period is very interesting, inasmuch as the gain made in 1914 was greater than that of the three preceding years combined. The curve showing the peak in kilowatts indicates a uniform advance, this showing that the new business is of a high load-factor and diversity-factor.



New Business Taken.



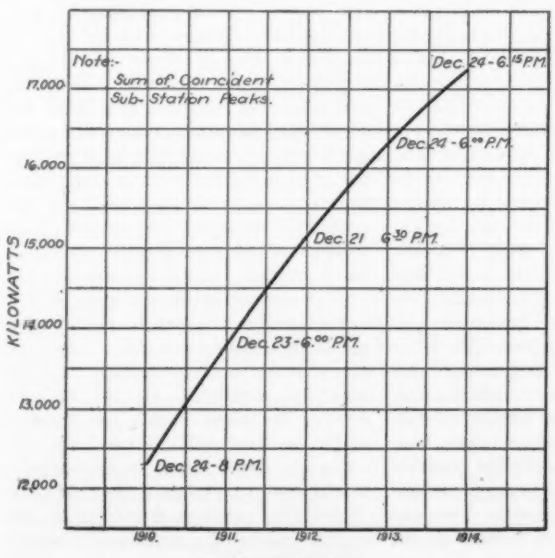
Total Revenue from Energy Sold.

Farm Exhibit in Columbus.

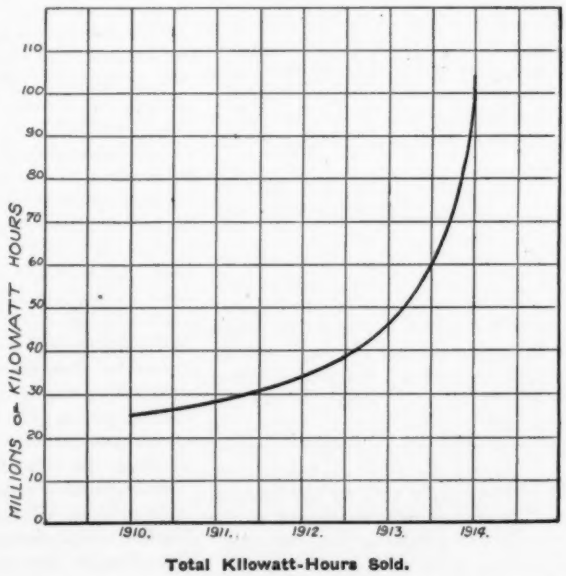
In the opinion of agricultural experts, farmers will soon be seizing upon the modern convenience of electricity in the home with the same avidity with which they are now taking hold of the automobile. This belief was reflected at Farmers' Week, Ohio State University, Columbus, O., February 1 to 5, by a lecture and demonstration on "Electric Light for the Farm."

This feature, which comprised one of many arranged for the 1,500 farmers who had registered for the week's college course, was under charge of C. M. Emerson, a farm engineer, of Columbus. On the stage of a large auditorium he had a full equipment of appliances, including incandescent lamps, washing machine, vacuum cleaner, and a number of small household conveniences, such as electric irons, toasters, etc.

The demonstration showed farmhouse and outbuilding lighting, with use in the latter of a semi-portable lamp by which dark corners could be explored without danger of fire. Another object-illustration showed the farmer's wife starting the washing machine while she was getting breakfast, and using electricity in the performance of various household duties during the day.



Maximum Peak.



Total Kilowatt-Hours Sold.

New-Business Plans of Rockford Company.

For the past few years the Rockford Electric Company, Rockford, Ill., has carried on a vigorous campaign for securing the business of already built houses and the excellent results that have been secured, particularly since the inauguration of the deferred-payment plan of payment, have more than justified the efforts that have been extended. The company has always refrained from engaging in house wiring and all of the business so far obtained has been turned over to the various electrical contractors. The plan has been to turn over to each contractor an equal volume of business and in addition a bonus has been given the contractors for contracts secured without the assistance of the central-station company.

The increasing business among owners of already built houses has progressed to such an extent, and the profits to the contractors have been such that a readjustment of the old plan was thought desirable by A. C. Martin, new-business manager of the company, and a new method worked out by which the contractors would stand their share of the expense. Without exception all have agreed to the change so that greater results than ever before are anticipated this spring.

Under the new plan an advertising fund is being created, into which each contractor pays $10 per month. This money will be used by the new business manager and will supplement the regular advertising of the company. By spring the fund will be of sufficient size to carry on a comprehensive campaign and as payments will continue throughout the year it will mean that there will be over $600 available for advertising.

Another feature of the Mr. Martin's plan is a co-operative scheme for employing salesmen for house wiring. The practice of the company in former years has been to add three special house-wiring salesmen to the regular force. This spring five extra salesmen will be employed and one man will be assigned to each of the five contractors of the city. A salary of $45 per month will be paid by the company to each man who will in addition receive a commission on each contract, these commissions to be paid by the contractor. These men will work out of the office of the company and be under the new-business manager.

This plan, it is thought, will work well for all concerned. The central station will obtain the services of five men for the cost of three, the contractor cannot lose as he pays a commission only on work he does, and the salesmen will be enabled to earn more than if receiving a straight salary, as the commissions are liberal and in addition the central station will continue to pay an extra commission of 25 cents for each domestic appliance sold.

Another innovation planned by Mr. Martin for the spring campaign will be the employment of a man whose sole duty it will be to secure prospects for the salesmen. He will have nothing to sell but will make a house-to-house canvass explaining the company's house-wiring proposition to every house owner in the city. This will enable the salesmen to devote their entire time to live prospects.

Many New Possibilities of Electric Heating and Cooking Brought Out in Meeting of British Central Stations.

According to a statement made by Harold Gray, electrical engineer, of the Accrington (England) Corporation, electric heaters of the radiant resistor type are rapidly superseding the luminous radiator as a heating medium, except for special purposes. The former renders possible toasting and grilling in a Dutch oven and sections can be cheaply renewed. Mr. Gray followed up his statement on this subject in an address to the Point Five Association in London, with an account of an experiment that he had carried out in connection with the heating of a church, where the congregation suffered from a severe down-draught. The electrical department, when appealed to for assistance, remedied the trouble in the following manner: A ring of resistance strips covered with expanded metal with occasional gaps, was run round the nave of the church at a height of 21 feet from the floor and 15 feet from the top of the main aisle. The total loading of the heaters was 20 kilowatts, the switching arrangements being such that either 10 or 20 kilowatts could be applied. This circuit was turned on early in the morning, with the ventilators in a definite position to create an upward current, and thus the humid atmosphere of the building was eliminated. Mr. Gray suggested that the development of this application might form a useful Sunday morning load. He later advocated simplification of the electric cooker, contending that a thoroughly reliable article could be obtained at a reasonable price if all elaborations were excluded. The simpler the machine the less trouble it would give in the long run. An electric cooker built on lines similar to those adopted for gas cookers appeared to give satisfaction in the majority of cases. It should be of cast iron construction, with removable fittings, with hot plate and grill on top of oven and without indicators, thermometers and inspection window. Of course, where the consumer was prepared to pay for a better class article elaborations were highly valued, but Mr. Gray saw no reason why the simpler class mentioned could not practically be standardized today admitting of cheapened manufacturing in large quantities. Hot plates could not be so easily standardized, but he thought that ultimately the most satisfactory type would be the radiant heat hot plate. Rapid operation could never be effected if the heating element had to heat up an iron plate as a preliminary to the heat being passed on to the cooking vessel.

Many interesting points of practical value emerged in the course of the discussion which followed Mr. Gray's address. For instance, Mr. Roles, city electrical engineer, of Bradford, reported that in his city there was hardly any demand for luminous radiators, and many consumers were using resistance heaters for toasting and food preparation, as well as for heating rooms. His principal trouble in regard to resistance heaters was not in selling them, but in securing them from the makers. Mr. Shaw, in the Ilford district, also finds the resistance type of heater the most popular, while at Worcester another engineer of the same name reports activity in converting lamp heaters to resistance type, a proceeding which can be done at small cost, and which modernizes the appliance. In the Worcester territory there is still at work in one of the flour mills an electric cooker which has been used for baking and testing bread for the past 20 years. The engineer of this same city said that if there could be put on the market an electric soldering iron with cheap reversible elements and satisfactory for industrial purposes, there would be a use for 1,000 of them in one canning factory alone. A. Hugh Seabrook, of Marylebone, mentioned a new method of heating rooms by thermostatic control, which by reducing current consumption would bring electric heating within the means of a far larger circle of consumers. At a street lavatory in his area of supply a thermostatically controlled electric hot-water system for wash basins has been installed, and though the full limit of its economy has not yet been reached it is already cheaper than gas. Mr. Seabrook also mentioned a block of flats which was being erected in his district. The builders have wired it for heating, cooking and lighting, electrically heated water will be supplied, and a consumption of 1,000,000 kilowatt-hours per annum, or 2,500 kilowatt-hours per head of its residents, is estimated. He gave this as an example of the enormous field of domestic electric service that still remained awaiting development.

An Effective Central-Station Advertisement.

The far-reaching effectiveness possible in the properly illustrated argument feature in central-station advertising directed to the consumer is effectively set forth in the accompanying reproduction of a recent advertisement of the New York Edison Company, appearing in New York dailies. Here is an announcement designed to attract and impress consumers and others with one important message—the lowering cost of electric light and power for house consumption; it is evident that it adequately fulfills this mission, and, more than likely, to a rather unusual degree.

Features have been incorporated in

Increasing the Purchasing Power of a Cent
Reduced rates for Edison Service and improved lamps, have raised the purchasing value of the American cent eighteen and one-half times. One cent will purchase as much electricity today as 18 cents did in 1884
What One Cent Will Buy
The New York Edison Company
At Your Service

Effective Advertisement of the New York Edison Company Appearing in Daily Papers.

this advertisement that carry a dual object: (1) To arouse particular interest from the viewpoint of the reader, a consumer or possible consumer, by dealing with the important element of *cost*, and (2) from the company end of using as a basis for this argument the familiar Edison figure, thus fostering in the reader's mind this established trademark in a novel manner.

With human interest caption, the message of "What One Cent Will Buy," is designed for creating attention and perusal, covering necessities common to every well equipped home; it is a convincing argument of reason. The employment of the Edison figure presents an illustrative idea that cannot miss its aim, for at a glance it drives home the message that the candlepower-hours obtainable for one cent have multiplied eighteen times from 1884 to 1914, or from 9.1 to 166 candlepower-hours.

As a specimen of central-station consumer advertising to reach a high point of efficiency and possibilities, this advertisement is worthy of very careful study.

Ice-Making by Central Stations Not Recommended in Massachusetts.

A special commission designated by the Massachusetts Legislature of 1914 to investigate the desirability of placing the business of supplying ice under state supervision and control, and of permitting electric light and power companies to engage in the manufacture and sale of ice, has reported to the present Legislature.

The Commission consists of the Attorney General, the Gas and Electric Light Commissioners and the Public Service Commissioners. Hearings held at Boston, Mass., were reported in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for October 24 and November 14, 1914.

On that portion of the subject which concerns central stations, the Commission recommends that it is inexpedient for central stations to engage in the ice business. It is pointed out that the charters of existing companies do not give this right. The proposal is a definite departure from present policy in Massachusetts. There are other businesses, the Commission says, that are more feasible for central stations to take up as side issues than ice-making, which has the disadvantage of involving long periods of idleness of apparatus during the winter seasons.

To enter this field might raise the issue of entering other lines of activity of varied nature, and this would complicate the effective supervision and regulation of lighting and power companies by the State Commission. "The electric companies have an immense field for their activities in the manufacture, distribution and sale of electricity alone, only as yet but partially occupied. The Commission believes that it would be unwise to divert their energies from, or to complicate the solution of, a problem of such essential importance to the public, and it finds no promise of a sufficiently compensating advantage to the consumers of ice," the report says.

The Commission recognizes the opportunity offered lighting companies to sell power at off-peak times, for the manufacture of ice by separate parties, especially by ice companies regularly supplying the natural product, as an auxiliary to the sources of natural ice, particularly in case of failure of sufficient natural ice being harvested.

The Commission further recognizes the fact that in the warmer parts of the country the lighting company is the natural and logical producer of artificial ice. The statement is made that in New York City manufactured ice seems to be displacing natural ice.

The Commission estimates the investment necessary to produce ice, at about $1,000 per ton of daily capacity, and that if a plant is operated continuously to its full capacity the cost of production would be about $1.00 per ton.

New York Edison Reduces Accidents One-Third.

The General Safety Committee of the New York Edison Company, in a report recently filed, records that in the last six months accidents to employees have been reduced 33.33 per cent. During the months of August, September, October and November, 1914, the operating departments were practically free from accidents. It is interesting to note that most of the accidents are of such a minor nature that the employees seldom miss even a day's work and that only nine per cent of the total number of accidents are caused electrically.

The company has always given the most careful attention to accident prevention and a special safety organization headed by J. L. Murrie, a safety engineer, has charge of the work. The General Safety Committee is composed of one representative from each department, who also act as chairmen of special field committees. The duty of the field committees is to spread the safety idea and obtain suggestions for improvements in safety methods. Monthly meetings of the general committee are held and careful consideration is given to all suggestions which are referred for final action to the officers of the company.

Electric Sign Data

Spectacular Theater Sign in Cincinnati.

The Cincinnati vaudeville house of the B. F. Keith syndicate has installed what is claimed to be one of the largest and most striking electric signs in the city, the work being completed and the lights turned on a few weeks ago. The sign is the work of the Electric Carriage Call Company, of New York. For some time the location of the theater, on Walnut Street, between Fifth and Sixth, had been designated at night only by an ordinary lettered sign showing its name, with a smaller sign at each end of the canopy bearing in electric letters the name of the head-liner. Manager Royal decided, however, that something more conspicuous was desirable, and the design submitted by the New York concern seemed to fill the bill admirably, as a brief description of it will show.

As usual with theater signs, the object of which is to point out the location of the house from a distance, thus serving the double purpose of enabling strangers to find it and of advertising it to the public in general, this sign is rather narrow for its relatively great height. Running up 58 feet above the canopy roof, it is considerably higher than the three-story building in which the theater is located, and is visible not only from points several blocks distant in the downtown section, but from the hill-top residence districts much farther away.

The greater part of the length of the sign is given over to the letters indicating the name of the theater—"B. F. Keith's," in block letters two feet high. These letters are painted in red, against a white background, making them almost as conspicuous during the daylight hours as at night. At night they are illuminated in red, standing out clearly with no background except that given by the broken lines of light representing water flowing from the fountain above.

This fountain is outlined at the top of the sign, and flows continuously, the flow being represented by flashing lights, flowing upward from the fountain to a height of about 12 feet above the bowl, and downward to the bottom of the sign. The figure of a fairy rests upon the bowl, and is completely lighted, with wings painted and ligted in purple, which are moved slowly when the sign is lighted, by a flashing device. The water is rendered very natural by the green caps in which it is outlined.

All of the lamps burn continuously, excepting those in the name of the theater, which flash on and off. At the bottom of the large sign a pair of 15 foot boards, around which green lights similar to those in which the water of the fountain is shown, come together, displaying the names of the head-liners for the week's bill in electric lights. Another sign, bearing the word "Vaudeville" at each end of the big canopy, is also electrically illuminated, while the under side of the canopy is studded with several hundred bulbs, making the exterior of the theater much the most conspicuous of any house in the city.

The bulbs used are 10 and 25-watt tungstens, to the number of about 2,300. With the other lighting arrangements referred to, there is a total of some 3,000 bulbs used on the front of the theater, indicating the extent to which the management believes in the advertising value of ample electric lighting. The large sign is connected by angle irons to a pair of long, heavy steel beams, which in turn are anchored to the building itself, one by braces in the front of the building and the other by iron rods fixed to the roof. It took two weeks to erect the sign.

The completion of the work was marked by a dedication of the sign, presided over by Blanche Ring, the well-known actress.

Spectacular sign erected for Keith Theater, in Cincinnati, O.
The sign is 58 feet high and 4 feet wide. The base, containing announcement of week's bill, is 15 feet wide and 7.5 feet high.
The letters forming word "Keith's" are two feet high.
There are 2,300 lamps used of the 10 and 25-watt sizes.
The flashing and color effects are described in the text.

Electrical Construction

Proposed Changes in the Code to Be Considered by Electrical Committee.

As previously announced in these columns, the twentieth annual meeting of the Electrical Committee of the National Fire Protection Association will be held on March 24 and 25 at 123 William Street, New York City. The general meetings to be held on these days will take up for final recommendation or rejection numerous suggestions for amendments to the National Electrical Code submitted for the biennial revision. Nearly all the subcommittees of the Electrical Committee have rendered reports on such matters referred to them, and what seem to be the most important features thereof are given below. A multitude of other suggested changes has also been submitted to Ralph Sweetland, secretary of the Electrical Committee, and these will first be considered at meetings preliminary to the dates announced above. A few of the more important of these miscellaneous suggestions are also referred to.

At the meeting of the Electrical Committee held in Boston, Mass., on April 1, 1914, the following matters were considered and are recommended for adoption.

Changes in Code Recommended.

Rule 8, Section *c*.—Change to permit fuses of 10-ampere capacity instead of 6-ampere, provided the circuits do not exceed 660 watts.

Rule 50—Heading of Table, Page 96.—Change "601 to 7,000" volts to "0 to 600."

Rule 70, Section *a*.—Change fourth paragraph to read:

Where branch and feeder circuit wires are led around the inside of the cabinet, ample space must be provided within the cabinet so that it will not be necessary to run the wires upon the face of panelboards, nor over the devices. This space or gutter may be partitioned off by a barrier extending from the base of the panelboard or other device to the front of the cabinet and firmly secured in position. These barriers to be———inches in thickness.

Varnished Cambric Cable.—The Code to contain a provision allowing the use of this cable under certain conditions.

Link Fused Rosettes.—The Code to contain a statement that these are only approved for use in large mills as provided for in Rule 23, Section *d*.

Committee Opinions.

The following are opinions formulated by the Electrical Committee on permissible interpretations of the Code that do not necessitate its revision, the aim being to make only such changes in the Code as are made necessary by progress in the art and by the necessity to safeguard against hazards:

Fuses in Multiple.—The committee has considered the question of protection of large-size wires by inclosed-type fuses connected in multiple, and is of the opinion that for the protection of wires having safe carrying capacities exceeding the rated capacity of the largest approved inclosed-type fuses it will be satisfactory to use approved inclosed fuses arranged in multiple, provided as few fuses as possible are used and the fuses are of equal capacity, and provided the cutout terminals are mounted on a single continuous pair of substantial busbars. The total capacity of the fuses should not exceed the safe carrying capacity of the wires. The above does not apply to motor circuits.

Steel City Box 4¼.—That this device should be classed as a box and not as a ceiling plate.

Junction Boxes in Attics.—Such boxes are considered to be accessible when installed in an attic that has sufficient head room, but which is reached only by a portable ladder and permanent hatch.

The following are reports of most of the subcommittees, somewhat condensed.

Report of Committee on Transformers.

Rule 81. Transformers.—Change to the following:

a. Construction.—Must be completely inclosed in substantial cases of sheet metal not less than No. 22 U. S. gauge in thickness, or of cast iron not less than one-eighth inch in thickness, and so constructed that when mounted on a plane surface the casing will make contact with the surface and maintain an air space of at least one-fourth inch between the casing and the supporting surface.

Leads of approved stranded cable at least six inches in length and so secured as to prevent strains coming on the connections to the coils, must be brought out of the case through individual approved insulating bushings, except for bell-ringing and toy transformers, the secondary terminals of which may be binding-posts mounted on the case.

AIR-COOLED TRANSFORMERS.

b. Marking.—Must be plainly marked, where it can be readily seen after installation, with the name of the maker, with the frequency, the primary and all secondary voltages, and the rated capacity in kilovolt-amperes.

c. Test.—Must be so constructed as to withstand the following tests:

1. Normal voltage shall be applied to the primary winding, and the secondary circuit shall be loaded to full rated current until a constant temperature is indicated by a thermometer on the case when the insulation must withstand a voltage test between high-voltage and low-voltage coils and between high-voltage coils and the core made in accordance with the Standardization Rules of the American Institute of Electrical Engineers.

2. Normal voltage shall again be applied to the primary while the transformer is still heated to full operating temperature and the secondary circuit loaded to three times rated current until a constant temperature is indicated by a thermometer on the case, or until burnout occurs.

The case must not be injured by this test and if the transformer is burned out there shall be no escape of flames or molten metal.

BELL-RINGING OR OTHER SIGNALING TRANSFORMERS.

d. Transformers for bell ringing or other signaling service must be constructed in accordance with the requirements of "*a*" and the following specifications, and may be approved for use when all wiring on the primary side is in accordance with the requirements of Class C.

e. Marking.—[Similar to "*b*," but terminals must be marked "Line" and "Bell"; primary must not be over 125 volts.]

f. Tests.—The design of the transformer must be such that when any two secondary terminals are short-circuited while the rated voltage is impressed on the primary, the input measured by a wattmeter in the primary circuit will not be more than 25 watts.

The transformers shall be run at normal primary voltage and with the secondary short-circuited until a constant temperature is reached, as indicated by a thermometer on the outside of the case. The rise in temperature so measured shall not exceed 50 degrees centigrade.

At the end of the heating test above, the insulation shall withstand for one minute the application of 2,500 volts alternating current between primary and secondary coils and between primary and core or case.

TOY TRANSFORMERS.

g. Transformers for operating toys must be constructed in accordance with the requirements of "*a*" and the following specifications:

h. Marking.—[Similar to "*b*"; primary must not exceed 125 volts and secondary 25 volts.]

i. Tests.—[Similar to "*f*", but input on short-circuit must not exceed 250 watts, and secondary current 10 amperes.]

Report of Committee on High-Potential Pole Lines.

Recommendations are:

Rule 13, *A*. Subways.—[Two new rules, *a* and *b*, to safeguard traffic from open manholes and to guard against gas ignition.]

Rule 12, *m*. Services.—[New rule.]

1.—Each premises shall be supplied by a separate service entering on the side nearest to the point of supply on the main. This requirement is not intended

to apply to factory yards and buildings under single occupancy or management.

2.—Where a row of separate premises is to receive its supply from an overhead main, one service cable shall be run from the pole to the row, and from the first attachment to the building subservices or a service main shall extend in conduit along the face of the row. One service cable shall supply not more than five premises, except under special permission in writing given in advance.

3.—The same plan of subservices may be employed in connection with underground services, under the same restriction.

Rule 17, Section *d*. No underground service from a subway to a building, and no service from a private generating plant shall supply more than one building, except by special permission, unless the conductors are carried outside all the buildings but the ones served. Conductors buried under two inches of concrete under a building, or buried back of two inches of concrete or brick within a wall are considered as lying outside of the building. These requirements do not apply to factory yards and factory buildings under single occupancy or management.

Rule 12, Section *b*, first paragraph. Amend to read:

Line wires must be so placed that moisture cannot form a cross connection between them; must be not less than one foot apart except when in conduit or in the form of multiple-conductor cable which is at least one foot from woodwork; must not be in contact with any substance other than their insulating supports. Multiple-conductor cables must be secured to strain insulators spaced as above described from any adjacent woodwork and in turn secured to petticoat insulators by strain wires.

Rule 12, *b*. Add a third paragraph to read as follows:

Must, for services of No. 6 B. & S. gauge or smaller, consist of approved rubber-covered multiple-conductor cables, and must enter the building in the manner prescribed by second paragraph of Rule 12, Section *f*.

Rule 12, Section *f*. Amend second sentence, second paragraph, by adding, "which must be kept at least 12 inches away from adjacent woodwork."

Report of Committee on Theater Wiring.

Among the many recommended changes and additions to Rule 38 the following are summarized:

Rule 38, Section *c*.—Switchboards must also comply with Rule 3 under Class A; this to be designated as Section 1. New Section 2 requires dimmers to be dead when their switches are open.

Rule 38, Section *d*.—At least one-half inch separation between metal of box and footlight receptacle terminals. Also change to permit 32 instead of 26 receptacles on one circuit.

Rule 38, Section *e*.—Permit 32 receptacles instead of 26.

Rule 38, Section *u*-1.—Replace present section with the following:

Arc lamps must be constructed so far as practicable in accordance with the requirements of No. 38 *k*, 1, 2, 3, 4 and 6, and incandescent lamps must be suitably inclosed. In either case the inclosure must be so ventilated or inclosed that no outside exposed surfaces will attain a temperature exceeding 250 degrees Fahrenheit under conditions of continuous service.

Rule 38, Section *u*-7.—Defines what is "properly ventilated" in moving-picture booths.

Rule 38, Section *v*.—New requirements for moving-picture outfits of miniature type for homes, lectures, etc. Must not take over 660 watts; films of slow-burning type; regular commercial theater films not allowed.

Committee on High-Wattage Lamps.

The recommendations of this committee are as follows:

That present matter referred to in Rule 35, namely "Economy Coils," should be transferred to and form a section of Rule 33, and that a new Rule 35 read as follows:

35. Gas-Filled Incandescent Lamps

a.—Must have a cutout for each lamp, except that where the combined wattage of two or more lamps does not exceed 660 watts they may be dependent on the same cutout for protection. In cases where wiring equal in size to No. 14 B. & S. gauge wire and of approved asbestos or slow-burning insulation is carried directly into keyless sockets or receptacles, the circuits may be so arranged that not more than 1,320 watts will be dependent upon the final cutout, except that where a single socket or receptacle is used on a circuit the limitation of watts permissible on the final cutout shall be the maximum capacity for which such socket or receptacle is approved.

Where lamps are on the outside of buildings wire must be of approved rubber insulation.

b.—Must not be used in show windows or in other locations where inflammable material is liable to come in contact with lamp equipment, except where used in connection with approved fixtures where temperature of any exposed portion of same does not exceed 200 degrees Fahrenheit.

c.—Must not be used in connection with medium-base sockets or receptacles if of above 200 watts capacity, nor with mogul-base sockets or receptacles if of above 1,500 watts capacity.

Must not, if provided with a shade, reflector, fixture or other inclosure above the socket, be used in metal shell fiber-lined, or similar sockets or receptacles of either medium or mogul-base types if of above 100 watts.

d.—Inside fixtures must be of especially approved type, and the conductors from fixture outlet to and entering socket must be of approved slow-burning or asbestos insulation.

Committee on Variable-Speed Motors.

This committee suggests a revision of the table following Rule 8, Section *b*, fourth paragraph, which gives current to be used in figuring the leads of motors for various classes of service.

Rule 8, Section *h*, second paragraph.—Change to include direct-current motors also.

Committee on Construction of Sockets.

Among other recommendations of this committee are:

Rule 72, Section *e*. Cap.—Change third paragraph to read:

In pendent sockets there must be sufficient room in the cap for a knot in the cord without crowding. All parts of the cap upon which the knot is likely to bear must be smooth and well insulated.

Rule 72, Section *p*.—Sockets of Insulating Material.

Sockets made of insulating material must not soften when subjected to a temperature of 200 degrees Fahrenheit; must not be readily combustible or absorptive of moisture. All parts must be of substantial construction to prevent breakage, particularly when materials of a brittle quality are used.

Lead wires furnished as a part of sockets and intended to be exposed after installation must be of approved stranded, rubber-covered wire, not less than No. 14 B. & S. gauge (No. 18 B. & S. gauge for candelabra sockets), be sealed in place and spaced at the point of entrance to the shell a distance of one-quarter inch in the clear from each other, or from exterior parts of the socket.

Rule 31, Section *d*.—New paragraph to read:

Sockets having shells of brittle material being subject to breakage, and constituting a hazard when broken, will not be accepted for use in places where they would be exposed to hard usage, unless supplied with approved guards.

Rules 31, *e*.—New paragraph to read:

Sockets having linings of paper fiber, or when constructed with insulating materials injuriously affected by a temperature of 200 degrees Fahrenheit should not be used where exposed to such temperatures, nor with ordinary incandescent lamps rated at more than 200 watts, or gas-filled lamps rated at more than 100 watts.

Rule 23, Section *d*.—Change second paragraph to read:

By special permission, in cases where approved wire not less than No. 14 B. & S. gauge in size is carried into approved receptacles or fixtures, and when the location is such as to render unlikely the use of portables, circuits requiring 1,320 watts and individual lamp units of any capacity may be dependent upon the final cutout.

Committee on Grounding of Conduit.

Rule 12, Section *f*.—Add new paragraphs, as follows:

Must have the metal of the conduit permanently and effectually grounded to water piping, gas piping or other suitable grounds, provided that when connections are made to gas piping, they must be on the street side of the meter.

If conduit, couplings or fittings having protective coating of non-conducting material such as enamel are used, such coating must be thoroughly removed from threads of both couplings and conduit, and such surfaces of fittings where the conduit or ground clamp is secured in order to obtain the requisite good connection. Grounded pipes must be cleaned of rust, scale, etc., at place of attachment of ground clamp.

Connections to grounded pipes and to conduit must be exposed to view or readily accessible, and must be made by means of approved ground clamps to which the ground wire must be soldered.

Ground wires must be of copper, at least No. 10 B. & S. gauge (where largest wire contained in conduit is not greater than No. 0 B. & S. gauge), and need not be greater than No. 4 B. & S. gauge (where largest wire contained in conduit is greater than No. 0 B. & S. gauge). They shall be protected from mechanical injury.

Fine print note:

The ground on the conduit system is

not to be considered as a ground for the secondary system (See No. 15).

Committee on Induction Motors.

Among recommendations by this committee are:

Rule 8, Section *c*.—Amend the last paragraph to read:

Where rubber-covered wire carries the current of only one alternating-current motor of a type requiring large starting current, it may be protected by fuses or an automatic circuit-breaker without time-limit device, in accordance with Table B of Rule No. 18. The rated continuous current capacity of a time-limit circuit-breaker protecting a motor of the above type need not be greater than 125 per cent of the motor current rating, providing the time-limit device is capable of preventing the breaker opening during the starting period.

Fine print note:

In the great majority of cases where alternating-current motors of the above type are started by means of autostarters, the current capacity of wires meeting the rule will not exceed the following percentages of the full-load currents of the motors.

Rated full-load current.	Percentage.
0- 30 amperes	250
31-100 amperes	200
Above 100 amperes	150

Rule 23, Section *e*.—Amend third sentence of first paragraph to read as the proposed amendment to Rule 8, Section *c* above.

Committee on Garages.

The committee recommends the following new rule covering garages in which are kept cars carrying volatile, inflammable fluid for fuel or power. In addition to the general requirements of the Code the following rules shall apply:

New Rule. Garages.

a.—All wires except those required for pendent lamps or portable connections must be installed in approved metal conduit or approved armored cable, except that approved metal molding may be used only in offices and showrooms. Metal conduit, armored cable or metal molding must be so installed that all outlet and junction boxes shall be located at least four feet above the floor.

b.—Flexible cord for pendent lights must be approved reinforced cord.

c.—Flexible cords for portable lamps, motors or other apparatus must be approved cord designed for rough usage. The portable cord must carry the male end of an approved pin-plug connector or equivalent, the female end being of such design or so hung that the connector will break apart readily at any position of the cable. The connector must be kept at least four feet above the floor.

d.—Flexible cable for charging must be of approved theater-stage type, this cable carrying parts of approved connectors of at least 50 amperes capacity. The connectors must be of such design or so hung that at least one will break apart readily at any position of the cable. Current-carrying parts of connectors must be shielded to prevent accidental contact. The fixed, or wall connector, must be kept at least four feet above the floor, and if not located on switchboard or charging panel, must be protected against accidental contact.

e.—Cutouts, switches and receptacles must be placed at least four feet above the floor, except as provided in Section *g* below.

f.—All portable lights must be equipped with approved keyless sockets of molded composition or metal-sheathed porcelain type. These sockets must be equipped with handle, hook and substantial guard.

g.—Switchboards and charging panels, if not located at least four feet above the floor, must be located in a room or inclosure provided for this purpose.

h.—Motors or dynamos, not actually a part of a vehicle, if not located at least four feet above the floor must be of the fully inclosed type. Motors located four feet or more above the floor, if not of the fully inclosed type, must be provided with wire screen of not less than No. 14 mesh over openings at commutator end.

Switch and Cutout Committee.

Rule 19, Section *a*.—Add a second and a third sentence reading:

In two or three-phase, three-wire circuits and two-phase four-wire circuits there must be a trip-coil in each of two phases, and in four-wire three-phase circuits there must be a trip-coil in each phase. If a circuit-breaker is also used in place of the switch it must be so arranged that no one pole can be opened manually without disconnecting all the wires.

After carefully reviewing test data and field experience with the refillable type of inclosed fuse during the past two years the following committee opinion was unanimously voted:

It is the opinion of the committee that experience has not yet shown that fuses in which the fuse element is intended to be replaced or renewed by the user are satisfactory in test or in field service to a degree warranting the recognition of the principle of refillable fuses in the rules of the National Electrical Code.

Committee on Cabinets.

This committee makes many recommendations, among which are the following:

Rule 8, Section *d*.—Requiring autostarters in wet or dusty places, unless of inclosed type, to be placed in approved cabinets.

Rule 19, Section *b*.—Substitute the following for the present rule (both paragraphs):

Must, when placed where exposed to mechanical injury or in the immediate vicinity of easily ignitible stuff or where exposed to inflammable gases or dust, or flyings of combustible material, or where unauthorized persons may have access to them, be mounted in approved cutout boxes or cabinets, except oil switches, circuit-breakers and similar devices which have approved casings.

Cabinets and cutout boxes must be of metal when used with metal conduit, armored cable or metal-molding systems.

Rule 19, Section *c*.—Substitute the following for the present paragraphs:

Must, when located where exposed to moisture as in basements and similar places, be mounted in approved cutout boxes or cabinets, and when located in wet places or outside of buildings must be mounted in approved "weatherproof" cutout boxes or cabinets.

Rule 23, Section *c*, second paragraph.—Change to read as follows:

Link fuses may be used only when mounted on approved bases which, except on switchboards, must be mounted in approved cutout boxes or cabinets. A space of at least two inches must be provided between the open-link fuses and metal, metal-lined or glass-paneled doors of cabinets or cutout boxes.

The committee recommends new specifications for the construction of cutout boxes and cabinets to replace present Rule 70, Sections *a* to *h*, inclusive.

Committee on Fixtures.

Among recommendations of the committee are the following:

Rule 30.—Add a new rule (taken out of Rule 24, *e*, which concerns *switches* and which is therefore an obscure place for the *fixture* rule) as follows:

For fixtures which are not attached to gas pipes or conduit, unless outlet boxes or other approved fittings which will give proper support for fixtures are used, a seven-eighths-inch block must be fastened between studs or floor timbers flush with the back of lathing to hold tubing and to support fixtures. When this cannot be done, wooden base blocks, not less than three-quarters of an inch in thickness, securely screwed to lathing, must be provided.

New specifications for the construction of fixtures are recommended to replace the present Rule 77. Also new specifications for insulating joints, Rule 76.

Committee on Safety to Life.

Rules 1, Section *c* and 8, Section *a*.—Change second and third paragraphs of 1, *c* and corresponding paragraphs of 8, *a* to read as follows:

Must, when operating at a potential of 550 volts or less, have their base frames permanently and effectively grounded wherever feasible. Where grounding of the frame is impracticable, special permission for its omission may be given in writing, in which case the frame must be permanently and effectively insulated. Wooden base frames used for this purpose and wooden floors which are depended upon for insulation, where for any reason it is necessary to omit the base frames, must be kept filled to prevent absorption of moisture and must be kept clean and dry.

Rule 2, Section *a*.—Change last sentence to read:

Where protection against moisture is necessary, cable with grounded lead sheath or grounded metal conduit must be used.

Rule 3, Section *a*.—Change last sentence to read:

The space back of the board must be kept clear of rubbish, must not be used for storage and must be inclosed by gates or gratings.

Rule 8, *f*.—Recommended to omit the requirement for a waterproof cover.

Rule 11, *b*.—Change last paragraph to read:

Transformer cases or frames used exclusively to supply current to switchboard instruments must be grounded unless they are installed and guarded in all respects as required for the higher voltage circuit connected to them.

Rule 12, *c*.—Recommended that this rule should be changed to read:

Must be at least eight feet above the highest point of roofs over which they pass or to which they are attached, and roof structures must be substantially con-

structed. Wherever feasible, wires crossing buildings should be supported on poles independent of the building.

Rules 20, 21, 22.—Recommended to omit these rules from the Code, and to expand Rule 23 to provide for the inclosures of arc lamps on constant-potential circuits under the same provisions at present made in Rule 21.

Rule 23, *a*.—Recommended to change the second paragraph to read:

The switch required in No. 24, *a*, and the cutout required by this section must be installed in an approved cabinet.

Rule 23, *a*, third paragraph, new rule reading:

Must not be inserted in grounded conductors, or ground wires except that they may be used in final two-wire circuits.

Rule 23, *b*, insert exceptions in the first and second paragraphs of this rule, referring back to Rule 23, as revised just above, thus permitting the omission of the fuses in grounded wires or ground wires where there is a change in the size of the conductor.

Rule 32, *d*.—Change this rule to read:

Must not be used except for pendents, wiring of fixtures, portable lamps or motors, portable heating apparatus or other portable devices.

Rule 26, heading under title "Low-Potential Systems."—After prolonged discussion, it was suggested that it be proposed for further discussion by the Electrical Committee to change this heading so that the first sentence would read:

Any circuit attached to any transforming device, machine or combination of machines which develops a difference of potential between any two wires or between any wire and the ground of not over 550 volts, etc.

Committee on Grounded Concentric Wiring Systems.

The report of this committee was published in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of February 6, page 244. It drew up a tentative set of requirements on this subject, but asks to be continued so as to give the matter further study. No rules on concentric wiring are recommended for inclusion in the Code at the present time.

Laboratory Reports.

Based on the reports of the Underwriters Laboratories, it is recommended to broaden Rule 25 to cover portable devices in general, as well as electric heaters.

New requirements are recommended for testing receptacles for attachment plugs, new specifications for their terminals, markings, etc.

Miscellaneous Suggested Changes in the Code.

Of the over 200 suggestions from miscellaneous persons for changes in the Code, which have been filed with the secretary of the Electrical Committee, it is possible here, because of space requirements, to allude to but a very few. Among these are the following:

No fuses or switches on back of switchboards, unless placed on auxiliary panel back of busbars and apparatus.

New values for carrying capacities of wires.

More liberal requirements as to grounding.

Specifying standard sizes of conduit for various numbers of wires per duct.

More stringent insulation of fixtures.

All sockets of screw-shell type with shell on grounded side of system.

Flexible cord on grounded systems to be made as concentric conductor.

Specifying dimensions of soldering lugs.

New rule to insure liberal sizes for service feeders and sub-feeders.

Brooklyn Contractors Guests of Edison Electric Illuminating Company at Annual Dinner.

For the ninth successive year the Edison Electric Illuminating Company of Brooklyn (N. Y.) tendered to the local electrical contractors a get-together dinner, the affair this year being held on February 10, in the banquet hall of the Academy of Music. About 350 were present. The hall was elaborately decorated for the occasion, many electrical effects being provided.

T. I. Jones, general sales agent of the Brooklyn company, acted as toastmaster and addresses were made by W. F. Wells, vice-president of the company, Louis Kalischer, a prominent local contractor, Lewis H. Pounds, borough president, Edward E. McCall, of the New York Public Service Commission, and William Williams, head of the Department of Water, Gas and Electricity, of Brooklyn.

Mr. Jones, before introducing the speakers, called attention to the remarkable growth of Brooklyn within the last few years, particularly in building construction. Mr. Wells, the first speaker, discussed the business outlook for 1915, predicting a more prosperous year than is generally expected. Credit and confidence, the two most important factors in business, have been restored, he said.

Mr. McCall spoke of the work of the Public Service Commission since his connection with it, particularly as regards transit development in Brooklyn. He attributed the rapid growth of the city to the development and improvement of transportation facilities and predicted a continuation of this growth.

Speaking of the possibilities of the future, Lewis H. Pounds, borough president, said that one of the assets of the city is its public service corporations and the men engaged in these enterprises. "The advance made in the last five years in Brooklyn in the work of these corporations is tremendous."

"Electrical Contracting" was the subject of an address delivered by Louis Kalischer, an electrical contractor of Brooklyn, and president of the Kilowatt Club, a local organization of electrical contractors. The address dealt mainly with the elimination of "extras" in charges for electrical contracting, which could be brought about by proper co-operation between those interested.

The consulting engineers, he said, should state clearly, not generally, what materials are to be used and just how they are to be installed, and owners should exercise more care in stating what they desire to accomplish, and then secure estimates only on the same layout.

Mr. Kalischer said that the contractor should be accorded a fair opportunity to figure the cost of the work, by having the plans and specifications at his office, and sufficient time to study the same. This not only eliminates a large percentage of the extras, but is fairer to the contractors.

The true electrical contractor is a valuable asset to the lighting companies, the municipal authorities and the public in general. The public looks to him for advice on all electrical matters whether they are the lighting company's contract or the rates obtained from municipal plants. His constant effort is to perfect his organization so as to increase the efficiency and service of same.

That this can be done is clearly demonstrated by the great difference that exists in the conduct of the work performed under the supervision of a first-class engineer or contractor, and the same type of work carried on by the various municipalities. The contractor gets quicker and better results: and the work is, at times, of a better type, at a cost commensurate with the results obtained. The contractor has been schooled in the business world, to not only consider the electrical and mechanical possibilities, but to view same from a strictly commercial standpoint. As a matter of fact, the contractors' whole effort seems to be centered upon one object, and that is, to complete the work at the lowest possible cost to the public.

Mr. Kalischer, in closing, referred to the activities of the Kilowatt Club and its influence in bringing the electrical interests of the city into closer touch.

Electricians' Licensing Bill Presented in Massachusetts.

A bill has been presented in the Massachusetts Legislature, at the instance of a committee composed of A. M. Moody, of the Wetmore-Savage Company, Boston, representing supply houses and jobbers; E. L. Dennis, rep-

resenting the International Brotherhood of Electrical Workers, and Alfred J. Hixon, representing the Massachusetts Electrical Contractors' Association, providing for the licensing of contractors and workmen in the State.

A large and enthusiastic hearing took place February 12 before the Legislative Committee on Public Lighting. The sentiment of those in attendance was practically unanimous in favor of the bill, as was evidenced by a show of hands.

The bill provides for the appointment of three State Examiners of Electricians by the Gas and Electric Light Commission. The first examiner shall be clerk and receive $2,000 per annum; the other two shall be paid $1,500 each or less. The first examiner shall be a practical electrician, the second an electrical inspector and the third, of such qualifications as the Commission shall see fit.

The examiners shall hold frequent examinations in Boston, and twice a year in at least five other cities. Two forms of licenses shall be issued: "A" to master electricians, enabling an individual, firm or company to engage in the business, and "B" to journeymen. The fees are $25 and 50 cents a year, respectively.

Fines of $10 to $100 are prescribed for engaging in business or work without a license.

Any firm, person or corporation holding a master's certificate shall not be held liable for work done by employees without authorization.

The bill does not apply to municipal departments, electrical plants, street railway, telephone, telegraph or transmission companies.

The prospects for the passage of the bill are excellent.

Why Jones Went Broke.

A good many electrical contractors appear to think that the matter of overhead expense has been stressed too much by the associations, trade journals and other agencies, and that there is too much theory involved in the discussions. For their edification the true story of a contractor who will be called John Jones, in lieu of his real name, may be related.

Jones was a good, hustling chap when he worked for the Smith Electrical Company, which has always had the lion's share of the contracting work in one of the larger cities of the Middle West. Being ambitious, which is a trait to be encouraged rather than frowned upon, he looked forward to the day when he should be his own boss, and when his name would appear on a sign over his own shop and store.

Finally, after having saved up enough money to carry him for a while, and having considered all of the openings for business which he thought he could command, he went to his employer and told him of his intentions.

"Well," said Smith, "I certainly wish you success. Remember, though, that the 'new beginner' always has a hard row to travel, and that you'll have to stand the gaff for a while before you begin to make any money. Don't be too eager for business, and make a profit on everything you do. That will seem slow work, but in the end it will pay."

With this advice in his ears, Jones went out and opened up a place on a less important thoroughfare than his former employer had. He hired two or three journeymen whom he knew, and put them to work on repair jobs which began to come in as soon as his establishment became known. He found it necessary, also, to get a bookkeeper, as he was out on the street most of the time, making himself *persona grata* to architects, owners and others who had known of him in connection with the Smith concern, and whom he wanted to think of him on his own account now. He was a bright, pushing fellow with an attractive personality, and everybody promised to do whatever they could for him.

He bid on everything that came along, and surprised himself by landing an important job right off the reel. He didn't doubt his ability to handle it, because his technical experience with the Smith outfit had been broad enough to give him ample confidence in his own ability. In this respect, by the way, many contractors of experience often do the novitiate an injustice, for cheap prices do not always mean ignorance of electrical installations; more often they suggest lack of knowledge of business methods rather than anything else.

Jones was too inexperienced to say, "What have I forgotten?" when the contract for a big motion picture theater dropped into his hands. All he saw in it was an opportunity to make some money. He knew he would have to hire some extra men, but he figured that his current collections from repair work, together with the small capital he had accumulated, would take care of his payroll, while the jobbers had indicated a readiness, based on his good character and the recommendation of his former employer, to credit him for the material.

The job developed a few new kinks, as nearly every contract of any importance does, and the labor expense was somewhat higher than Jones had expected. Also, with most of his men tied up on this work, he wasn't able to give attention to the minor jobs that turned up, which in reality should have been the pot-boilers, to keep things going, and many of them got away for lack of attention. The work took longer than he had expected it to, and as collections happened to be slow the necessity of financing the business to the extent of the payroll soon became an alarming matter, and before it was over with he had dug deep into his reserve fund.

When the job was finished, the inspector who went over it complimented him on the work, and Jones was immensely pleased to think that he had accomplishrd a task that would have been a credit to many an older contractor. He felt sure it would be a good advertisement for him, and both the architect and the owner of the theater promised to put in a good word for him. At his diffident request, the picture man agreed to pay the bill immediately, so that he felt things had broken pretty well.

He had not been following the cost figures very closely, however, turning all the invoices for material and memorandums of labor over to the bookkeeper; so the day after the job was completed, he asked her to total up all the items so he could see how much he had made. His bid on the work was $1,260; and he nearly fell off his chair when he was told by the accurate young woman who handled the accounts that labor and material together amounted to $1,193.

"What!" he exclaimed. "Impossible! Why, I figured that I would make at least $100 on that job!"

For answer she passed over the papers to him, and he began a feverish investigation, only to find that everything had been added up correctly. Then he tried to comfort himself with the reflection that if he hadn't made any money, he had at least got some excellent publicity and had made a permanent customer, and also that there wasn't a net loss, anyhow. Then he happened to think of his own time.

"If I had been working for the Smith Electrical Company," he mused, "I would have got $30 a week. I put in three weeks on this job, and as I didn't make anything on it, I'm out $90."

He sighed. That was his first introduction to overhead expense, in the form of supervision.

Then when the rent man came around the first of the month, and he paid out what seemed to him a pretty good chunk of money for the privilege of occupying his modest quarters, he began to wonder if he should have made provision for these expenses when he had figured on the job. And though his bookkeeper was getting only $10 a week, he finally decided that he couldn't afford to meet this expense, and told his employee reluctantly that he would

have to let her go. After that he tried to handle his own books, with the help of an expert accountant who came in two or three times a month to look things over.

Another thing which bothered him considerably was that customers who owed for repair work appeared to take their time about settling, and paid no attention to statements sent through the mails. He had relied on people for whom he did work paying promptly, so that he would be able to use the money in his business. He ultimately found out that the business man must have enough capital to carry accounts of considerable volume, and that the cost of carrying these, as well as the losses which necessarily accumulate, would have to come out of his profits.

He heard some talk of overhead expense.

"Why," he reasoned to himself, "I oughtn't to have enough of that to worry about. Now, if I were the Smith company, with a big store and shop, a lot of people who do nothing but keep books and sell stuff over the counter, and all that sort of thing, I might have to worry about it. But with my little hole in the wall, with no salary to figure for myself—I get all the profits!—and everybody connected with the payroll working, I ought to have practically no overhead, and for that reason can afford to bid under these older fellows, who have a lot more expense than I."

He failed to take into account the fact that, in proportion to the volume of business transacted, his overhead was just about as great as theirs; and that the additional expenses which they had represented chiefly opportunities to do business, such as selling supplies and electrical merchandise, added reputation and more numerous contracts. In other words, while he knew that something was wrong with his own business, the trouble didn't represent overhead to him.

One day, after he had been in business for four or five months, and had got almost to the bottom of his little pile, he had a talk with the accountant who was trying to straighten out his bills and his books. He explained as nearly as he could the way he had been running the business, and wanted to know if the expert could make any suggestions.

"How much do you allow for overhead?" inquired the accountant.

"Oh, I haven't any to speak of," replied Jones, breezily, waving his hand around the office as though to show how small and modest it was. "When I was over at Smith's they used to add a certain percentage to the hour costs of labor to take care of that; but in my little business I felt that I could get along without that, especially as I needed business; so I have been figuring just the bare cost of labor and material, plus the profit I wanted to make."

"Where is it?" asked his adviser.

"What?"

"Why, the profit," was the reply.

"Well, I haven't made any yet," said Jones. "That was what I wanted to ask you about. You see, I have had plenty of work, but what with the people who won't pay and those whose work cost more than I thought it would, I have been running a little behind."

"My boy," said the expert accountant, "just paste this in your hat: No business is so small that it has no overhead. The man who carries his office in his hat can't get away from all expenses, and anybody who does business incurs obligations outside of the productive labor and the material which go into his work. Unless you charge enough to take care of these expenses, and then leave a profit, you're done for."

Jones was game, and made up his mind to get more for his work after that; but, spurred on principally by the necessity of keeping busy, he insisted on bidding sufficiently under the prices he thought his competitors would quote to insure getting the contracts. He got enough to require Herculean labors on his part, inasmuch as he was trying to do a full day's work on his jobs, handle the office and make collections; and though he strained every nerve, working at night and rising betimes to get to the office, he became harder and harder pressed for money, the jobbers finally refused him credit, and the day came when he had to tell his men to look for other jobs.

They put him through the bankruptcy courts in a hurry, for his assets were practically nil. The supply houses were properly indignant, and seemed to have the idea that he had salted away some money somewhere, and, in spite of his previous record for honesty, had broken down morally when he found it possible to do business with other people's money. Jones went back to work for the Smith Electrical Company, which was glad to get him, for he is a rattling good man to have on anybody's job, and can get a lot of work out of his men. He himself thinks that his trouble was poor collections more than anything else, but Smith and the expert accountant agree that it was simply a case of financial indigestion, caused by unassimilated overhead expenses of the business.

One Method of Locating Faults in an Armature.

Shortly after my entry in the electrical business, as an adjunct to my laboratory, I purchased a second-hand K. & D. six-volt, six-ampere direct-current generator. This particular machine was well made, but positively would not carry any load, and became very hot running on open circuit, carrying the field excitation of about two amperes.

After considerable study I decided there was a short-circuit in the armature. All directions I could find called for a telephone receiver for the location of faults in armatures, but not having ready access to one, I hit on the following method, which worked perfectly.

Having an old telephone generator which I had rewound for four volts, I used this as a source of current instead of batteries or other source. Then as a substitute for a telephone receiver I used an old automobile spark coil.

The generator was connected to diametrically opposite segments of the six-section commutator, and the primary of the coil was connected between adjacent segments. The secondary leads from the coil being laid on my tongue, I could readily perceive any current, for the coil greatly magnified any slight difference of potential which should exist between commutator bars.

Testing around from bar to bar, I came to a pair between which there was almost no difference of potential, and after unsoldering the leads to the commutator, I found that the short-circuit was as shown by the foregoing test. After unwinding the defective coil and insulating the place where the shirt-circuit occurred, the machine easily generated up to its full rating without heating.

Great care should be used in making this test, as a shock would be decidedly unpleasant.

P. M. Blough.

Court Sustains Public Service Commission Ruling on High-Tension Wire Crossing.

Judge McCarrell, in the Dauphin County (Pa.) Court, has dismissed the appeal of the Public Utilities Company from the order of the Pennsylvania Public Service Commission which permitted the Lehigh Navigation Electric Company to cross its right of way with high-tension wires for the purpose of supplying service.

The court holds that a company incorporated prior to the passage of the Public Service Company Act of 1913 is not required to secure a certificate of public convenience in the territory covered by its charter, although contracts made with municipalities and other public service companies will have to be acted upon by the Commission.

Public Service Commissions

Conducted by William J. Norton

CALIFORNIA.

The Federal District Court has held that no public service company, subject to the jurisdiction of the Railroad Commission, can apply to the courts until after an application for a rehearing of the case in dispute has been acted upon by the Commission. The decision was rendered in the case of the Palermo Land and Water Company, in which the company had applied for an increase in rates.

CONNECTICUT.

Charles C. Elwell has been appointed as member of the Public Utilities Commission, to succeed Theodore B. Ford, for a term of six years. Mr. Elwell has been serving as chief engineer and inspector for the Commission.

Standard of Service. The Commission has prepared a tentative draft of uniform rules and regulations governing the supply of service by gas, electric and water companies.

ILLINOIS.

Robert M. Feustel, chief engineer of the State Public Utilities Commission of Illinois, has tendered his resignation to the Commission, to take effect March 5, 1915. Mr. Feustel, who was formerly assistant chief engineer of the Wisconsin Railroad Commission, was appointed chief engineer of the Illinois Commission a year ago, and has had charge of organizing the engineering department. Rules establishing standards of service for the various types of utility properties have been prepared under his direction and adopted by the Commission. The general method of collecting data for making cases has also been outlined, and this information the Commission will issue in pamphlet form in the near future. Mr. Feustel is withdrawing in order to give his entire time to the work of Sloan, Huddle, Feustel & Freeman, consulting engineers, of Madison, Wis., and Boston, Mass., of which firm he is a member.

NEBRASKA.

A bill has been introduced granting the Railway Commission the power to prevent duplication of public utilities, such as electric light and telephone companies, in localities where the Commission thinks the field is only large enough to support one.

NEW YORK—Second District.

The New York Telephone Company. The Olbiston Company, which owns several apartment houses located on adjacent corners in Utica, has been supplied by the New York Telephone Company at an old flat rate. The Telephone Company notified the apartment owners that this was a discriminatory rate, and upon the complaint of the Olbiston Company the matter of rates for such large apartment buildings was taken to the Commission. The Commission determined the matter as follows: The Telephone Company must supply the complainant with a private-branch exchange, with stations connecting its offices, boiler house, and other rooms not occupied by tenants at the rates quoted for business places. Tenants may then contract with the company for telephone service at residence rates, their telephones to be connected with the private-branch exchange system without extra charge and their names to be separately listed in the telephone directory. The order provides that the company must supply a sufficient number of trunk lines to handle the business contracted for.

OKLAHOMA.

A bill has been introduced extending the jurisdiction of the Corporation Commission over municipally owned public service plants, and has been reported upon favorably by the Committee on Public Service Corporations.

PENNSYLVANIA.

Lehigh Navigation Electric Company. The Dauphin County Court has sustained the decision of the Commission in the matter of the Pennsylvania Utilities Company vs. the Lehigh Navigation Electric Company. The petitioner sought to prevent the Lehigh Company from invading its territory in certain parts of Monroe and Northampton counties.

VERMONT.

The Fourteenth Biennial Report of the Public Service Commission has been issued in bound form. The report covers the period from June 30, 1912, to June 30, 1914, and contains the reports and orders of the Commission rendered during this period, and abstracts of the statistics and annual reports of the companies under its jurisdiction. Rates for electric companies, as shown by schedules filed with the Commission, are given in tabulated form.

Walter A. Dutton has been appointed as member of the Public Service Commission.

WISCONSIN.

The Beloit Water Gas and Electric Company was authorized to issue $100,000 of bonds. The proceeds of these bonds are to be used for extensions and permanent improvements to the plants and distribution system of the company.

Twelve Corners and Mackville Telephone Company was authorized to issue $3,280 of capital stock, proceeds to be used in building new lines and in making extensions to the present system.

Dayton Company Section Meeting.

The assembly room of the Dayton Power & Light Company was crowded on February 9, 1915, when H. M. Edwards, auditor of the New York Edison Company, of New York City, talked to the employees of the company under the auspices of the Dayton Power & Light Company Section of the National Electric Light Association on the "Relation between the Operating Employee and the Accounting Department."

Mr. Edwards first showed how the management of a large corporation is in the nature of a trusteeship for the property of others, and the responsibility for the successful management of the property of others necessarily requires a complete record of all the property belonging to the company, its income and expenses. The hearty cooperation of every employee in that company should be given to the accounting force of the organization to the end that a clear and truthful record can be made of the different operations of the company. This record should reflect the past experiences of the company which should be a faithful guide for the present and future activities of the company.

Following Mr. Edwards' talk, a half hour was given over to a discussion in reference to this important subject.

Electrical Engineering Problems.

By R. G. Hudson and W. V. Lyon.

DIRECT CURRENTS.

Problem 24.

The no-load power input to a 20-kilowatt, 230-volt, four-pole shunt generator, driven at 1,200 revolutions per minute and separately excited to a terminal voltage of 240 volts, is 1,320 watts. The armature is 14 inches in diameter and is wound with a simplex lap-winding containing 300 conductors. The flux-cutting length of each armature conductor is 10 inches.

Neglecting the effect of armature reaction, find the reactive torque of the armature (*a*) at no load under the above conditions and (*b*) when the armature current is 80 amperes. Find (*c*) the power input to this generator when the armature current is 80 amperes.

SOLUTION TO PROBLEM 24.

The power input to a generator at any load is given by

[40] $P=1.42ST/10^4$ kilowatts

or $P=1.90ST/10^4$ horsepower.

where S equals the rotational speed of the armature in revolutions per minute and T equals the turning moment or reactive torque of the armature in pound-feet. The resistance to turning or the reactive torque of a separately excited machine at no load is due to the friction in the bearings and brushes, windage, intermolecular friction of the iron molecules in the armature and to the force required to move the laminations carrying eddy currents through the flux which threads the armature.

Answer to Question a.

Since the input at no load is 1,320 watts the no-load torque is given by [40].

$$1.32=1.42\times1,200T/10^4$$

and $T=7.74$ pound-feet.

To turn this generator over at no load then requires an active torque equal to that required to turn over a sheave two feet in diameter from which a weight of 7.74 pounds is hung by a weightless rope.

Answer to Question b.

If a wire carrying a current I is placed in a magnetic field of density B so that the axis of the wire is perpendicular to the field and extends through the field for a distance of l, the force F acting upon the wire is given by

[41] $F=8.85BlI/10^8$ pounds.

where B is measured in magnetic lines per square inch, l in inches and I in amperes. The direction of this force may be obtained by holding the thumb, index and middle finger of the left hand in positions respectively perpendicular to each other. If the index finger points in the direction of the magnetic flux (magnetic flux flows in air from north to south pole) and the middle finger points in the direction of the current flow, the thumb will point in the direction in which the mechanical force acts upon the wire. Although following the same rule outlined above, it is helpful to note that when a loop of wire carrying a current is placed in a magnetic field the loop of wire will move to such a position that the flux linking the wire will be a maximum.

Since the flux-density around the periphery of an armature is not constant, the force acting upon the various conductors will not be uniform. The average force acting on a conductor, however, may be found by substituting the average flux-density in [41]. The total tangential force acting upon the armature is given by multiplying the average force (F) by the total number of conductors (Z), and the torque (T) is obtained by multiplying this product by the radius of the armature (R) measured in feet. Thus

[42] $T=8.85BlIZR/10^8$ pound-feet.

The average flux-density around the armature of the 20-kilowatt generator described in Problem 24 may be found as follows. The flux per pole (Φ) is given by [29].

$$240=4\Phi\times300\times20/4\times10^8$$

and $\Phi=4\times10^6$ lines.

The surface area of the armature covered by flux-cutting conductors equals the product of the circumference of the armature and the flux-cutting length of each conductor, $14\pi\times10$ or 440 square inches. Since the total flux entering or leaving the armature equals $4\times4\times10^6$ or 16×10^6 lines, the average flux-density equals $16\times10^6/440$ or 36,400 lines per square inch. The number of paths between brushes on a lap-wound armature equals the number of poles (see Solution of Problem 11) and since the total armature current is 80 amperes the current in each path equals 80/4 or 20 amperes.

Substituting these values in [42] the torque due solely to the reaction between armature current and field flux is found to be

$T=8.85\times36,400\times10\times20\times300\times0.583/10^8$
$=112.7$ pound-feet.

The total active torque required to turn the armature over against the stray-power torque and the reactive armature-current torque equals 7.74+112.7 or 120.4 pound-foot.

Answer to Question c.

The above method is not the shortest one for determining the armature torque at any condition of load, but is given to specify and explain the various factors upon which the armature torque depends. The torque may be determined more quickly by [40]. Since the armature voltage equals 240 volts and the armature current equals 80 amperes, mechanical energy is converted into electrical energy at a rate of 240×80 or 19,200 watts (by [19]). Adding the stray-power input (1,320 watts) the total input when the armature current is 80 amperes is 19,200 +1,320 or 20,520 watts. Substituting in [40],

$$20.520=1.42\times1,200\times T/10^4$$

and the torque (T) equals 120.4 pound-feet, which checks the answer to **Question b.**

It should be noted that [42] contains no factor depending upon the speed and that the reactive torque due to armature current therefore does not depend upon the speed. Since all of the stray-power losses depend upon the speed, the stray-power torque does vary with the speed of the armature. The speed of a generator being maintained nearly constant, the stray-power torque is sensibly constant (it varies somewhat with the excitation) and the principal cause of variation in torque is the change in armature current which accompanies a change in load.

SOLUTION TO PROBLEM 74.

Answer to Question a.

The vector diagram is given in Fig. 30a. We wish to find the angle, α, between the excitation voltages, E_1 and E_2. In the method described in the preceding problems for calculating the excitation voltage, its two components, along the current vector and perpendicular to it, were first computed. The ratio of the first of these to the excitation voltage is the cosine of the angle between the current and the voltage. This gives the angle between each current and the corresponding excitation voltage, and if the angle between the currents is known the angle between the excitation voltages is quickly found.

Since the alternators are star-connected the terminal voltage per phase is

ALTERNATING CURRENTS.

Problem 74.

Two three-phase alternators, each of which is rated to deliver 1,000 kilovolt-amperes at 1,320 volts, are directly coupled to the shaft of a water turbine. The armature windings are connected in star and have an effective resistance of 2.2 ohms and a synchronous reactance of 54 ohms per phase. The field structures have 30 poles. These alternators will not operate satisfactorily, that is, they will not divide the load equally between them and operate at the same power-factor. The probable cause is that the field structures are not properly set on the shaft. The alternators deliver a total constant load of 1,500 kilowatts. If the excitations are adjusted so that the first delivers 1,000 kilowatts at unit power-factor, the second delivers 500 kilowatts at a power-factor of 0.50. The terminal voltage has its rated value throughout the problem. (*a*) What is the angular displacement of the field structures relative to one another and what should be done to correct this? (*b*) The coupling is now adjusted so that the excitation voltages are in phase. If the field currents are also adjusted so that they are equal, what load does each alternator deliver and at what power-factor does it operate? Compare the present armature resistance losses with those when the load was divided as originally described. (*c*) The field currents are further adjusted so that the excitation voltage of one is increased 20 per cent, and that of the other is reduced the same amount. What power does each alternator deliver and at what power-factor does it operate? What are the resistance losses in each alternator?

$$V_p=13,200/\sqrt{3}$$
$$=7,620 \text{ volts.}$$

The armature current of the first is

$$I_p=1,000,000/3\times7,260$$
$$=43.7 \text{ amperes.}$$

Since the first alternator is operating at unit power-factor, the vertical component of V with respect to the current is zero.

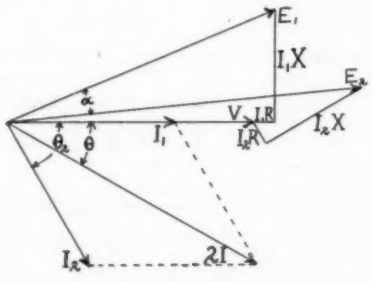


Fig. 30a.

By [19a] $(E_1)_h=7,620+43.7\times2.2$
$=7,716$
$(E_1)_v=0+43.7\times54$
$=2,360.$

By [20a] $E_1=8,080$ volts.

The cosine of the angle between E_1 and I_1 is 7,716/8,080=0.9554, and the angle is 17.0 degrees.

Turn the diagram so that I_2 is horizontal.

$$I_2=500,000/3\times7,620\times0.5$$
$$=43.7 \text{ amperes.}$$

The horizontal and vertical components of V are now

$$V_h=7,620\times0.5$$
$$=3,810$$
$$V_v=7,620\times\sqrt{1-0.5^2}$$
$$=6,600.$$

By [19a] $(E_2)_h=3,810+43.7\times2.2$
$=3,906$
$(E_2)_v=6,600+43.7\times54$
$=8,960.$

By [20a] $E_2=9,770.$

The cosine of the angle between E_2 and I_2 is 3,906/9,770=0.400, and the angle is 66.4 degrees.

The angle whose cosine is 0.5 is 60 degrees. The current in the second is thus 60 degrees behind the current in the first, since the current and terminal voltage of the first are in phase.

Therefore $\alpha=17.0+60.0-66.4$
$=10.6$ degrees.

This is the angle between the excitation voltages. Since the electrical angle between the centers of adjacent poles is 180 degrees, this angle of 10.6 degrees is 10.6/180 of the distance between the centers of adjacent poles. Since the alternator has 30 poles the space, or mechanical, angle between adjacent poles is 360/30, or 12 degrees. The space angle corresponding to the displacement between the excitation voltages is therefore

$$(10.6/180)\times12=0.71 \text{ degree.}$$

This angle of 0.71 degree is the amount by which the corresponding field poles of the two alternators are displaced from their proper relative position. The excitation voltage of the first leads that of the second. In order to bring them into phase the field structure of the second should be advanced in the direction of rotation 0.71 degree.

Answer to Question b.

If the preceding adjustment between the field structures is made, the excitation voltages will be brought into phase. If the excitations are also made equal, the alternators will each deliver the same load and operate at the same power-factor. The phase current delivered to the load is found by resolving I_2 into components along and perpendicular to I_1.

By [26a] $(2I)_h=43.7+43.7\times0.5$
$=65.6$
$(2I)_v=0+43.7\sqrt{1-0.5^2}$
$=37.9.$

By [27a] $2I=75.6$ amperes.

The power-factor of the load is

$$\text{Cos } \theta=65.6/75.6=0.868.$$

If the alternators deliver the same current at the same power-factor, the current is 75.6/2, or 37.8 amperes, and the power-factor of each is 0.868. The copper losses are each

$$(37.8/43.7)^2=0.75$$

of their values under the original conditions. This illustrates how important it is to set the field structures on the shaft properly. A very small angle in the case of generators that have a large number of poles will cause considerable trouble. When the excitation voltages are fixed in their phase relation, as they are in this problem, the load can be shifted from one generator to the other by adjusting the field currents. This is because the field structures are prevented from swinging relative to each other as they could if they were driven by independent prime movers. The next question further illustrates this point.

Answer to Question c.

The vector diagram is given in Fig. 31a. First find the value of the excitation voltages when they are equal as in question *b*. Turn the diagram so that $(2I)$ is horizontal. The horizontal and vertical components of V are then

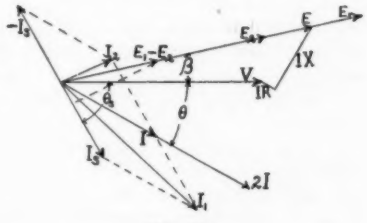


Fig. 31a.

$$V_h=7,620\times0.868$$
$$=6,610$$
$$V_v=7,620\times\sqrt{1-0.868^2}$$
$$=3,790.$$

By [19a] $E_h=6,610+37.8\times2.2$
$=6,693$
$E_v=3,790+37.8\times54$
$=5,830.$

By [20a] E=8,870 volts.

$\text{Cos}\ (\beta+\theta)=6{,}693/8{,}870$

$=0.755$

So that: $(\beta+\theta)=41.0$ degrees.

Before the excitations are changed, each has a value of 8,870 volts per phase and the armature currents are each 37.8 amperes. On the diagram these vectors are E and I. If the excitation voltage of the first is increased 20 per cent and that of the second is decreased the same amount, these voltages will be represented by the vectors E_1 and E_2. They cannot swing out of phase because the field structures are keyed to the same shaft. At this point the simplest way of completing the problem is by using the method of "interchange" current. Just as soon as the excitation voltages are not equal we can consider that the armature current in each generator is equal to what it previously was, plus a component current that is caused by the inequality of the excitation voltages and is equal to their difference divided by the impedance of the two armatures in series. For example, in this case we may consider that the armature current in the first alternator is equal to its original value, I, plus $(E_1-E_2)/2Z_s$. Z_s is the synchronous impedance of one generator.

Likewise the armature current in the second alternator is

$$I_2=I+(E_2-E_1)/2Z_s$$

On the diagram $(E_1-E_2)/2Z_s$ is represented by the vector I_s. The vector $(E_2-E_1)/2Z_s$ would then, of course, be represented by $-I_s$, which is also shown.

$E_1=1.20\times 8{,}870$

$=10{,}650$ volts

$E_2=0.80\times 8{,}870$

$=7{,}100$ volts

$E_1-E_2=3{,}550.$

By [5a] $Z_s=\sqrt{2.2^2+54^2}$

$=54.$

The value of this "interchange" component of the current is

$I_s=3{,}550/2\times 54$

$=32.9$ amperes.

It makes an angle with (E_1-E_2) whose cosine is 2.2/54. This angle is nearly 90 degrees.

More exactly $(\beta+\theta_s)=87.7$ degrees.

Since $\text{Cos}\ \theta=0.868$

$\theta=29.7$ degrees.

But $(\beta+\theta)=41.0$

so that $\beta=41.0-29.7$

$=11.3$ degrees.

Therefore $\theta_s=87.7-11.3$

$=76.4$ degrees.

The horizontal and vertical components of I_s are

$(I_s)_h=32.9\ \text{Cos}\ 76.^\circ 4$

$=7.7$

$(I_s)_v=32.9\ \text{Sin}\ 76.^\circ 4$

$=32.0.$

The horizontal and vertical components of the original current, I, are

$I_h=37.8\times 0.868$

$=32.8$

$I_v=37.8\times\sqrt{1-0.868^2}$

$=18.8.$

By [26a] $(I_1)_h=32.8+7.7$

$=40.5$

$(I_1)_v=18.8+32$

$=50.8.$

By [27a] $I_1=65.7$ amperes.

The power-factor of the first is

By [28a] $PF=40.5/65.7$

$=0.617.$

In order to find the current in the second alternator the current $-I_s$ must be added to the original value of the armature current. Thus

By [26a] $(I_2)_h=32.8-7.7$

$=25.1$

$(I_2)_v=18.8-32$

$=-13.2.$

The negative sign shows that the current, I_2, lies above the horizontal axis and is therefore leading the terminal voltage.

By [27a] $I_2=28.3$ amperes.

The power-factor of the second generator is

By [28a] $PF=25.1/28.3$

$=0.887$

In the first generator the copper loss is

$(65.7/37.8)^2=3.02$

times its value in question b.

In the second it is

$(28.3/37.8)^2=0.56$

times its value in question b.

The power delivered by the first generator is

By [1a] $P_1=3\times 7{,}620\times 65.7\times 0.617$

$=926$ kilowatts.

DIRECT CURRENTS.

Problem 25.

A 230-volt 20-kilowatt 1,200-revolutions-per-minute belt-driven shunt generator is operated in parallel with other generators. the voltage of the system being maintained constant at 230 volts. The armature resistance between brushes is 0.12 ohm. When running at 1,200 revolutions per minute with no armature current and connected electrically to the system the mechanical input to the generator is 1,320 watts.

If the belt should slip off the pulley under these conditions find (a) the speed of the armature and its direction of rotation, (b) the magnitude and direction of the armature current, (c) the electrical power input to the armature and (d) the stray power, assuming that the stray power is proportional to the armature voltage.

This problem illustrates the difference between generator action and motor action in a dynamo.

Problem 75.

The following test data are given on a 1,500-horsepower, 13,200-volt, three-phase synchronous motor:

Field Current	Open-Circuit Terminal Voltage	Terminal Voltage I_a=49, $P.F.$=0	Open-Circuit Core Loss
50	8420	.....	8.4
80	12400	.....	18.6
110	14900	10300	28.4
140	16500	12700	37.5
180	18100	14900	....

The armature windings are connected in star and have a hot resistance of 2.52 ohms measured by direct current between terminals. The ration of effective to direct-current resistance is 1.55. The resistance of the field circuit is 0.61 ohm. The friction and windage loss is 9.32 kilowatts.

This motor is operating on a 13,200-volt circuit and delivers a constant load of 1,250 horsepower. (a) The excitation is adjusted so that the motor takes a line current of 50 amperes at a lagging power-factor. At what power-factor does it operate? What is the necessary field current? What is the efficiency of the motor? (b) To what value should the field current be increased so that the motor will take the same current at a leading power-factor? What would be the efficiency in this case? (c) What is the least value that the armature current can have? What would be the necessary excitation voltage? Compare the armature resistance loss with that under (a) and (b).

Solutions of the above problems and two new problems will be printed in the next issue.

The power delivered by the second is

By [1a] $P_2 = 3 \times 7{,}620 \times 28.3 \times 0.887$
$= 574$ kilowatts.

This division of the load is now nearly as unequal as under question *a*, while the armature heating is much too large in the first generator. This shows the importance of equal excitations in such a case.

Massachusetts Hearing on Rates.

A continued hearing on the bill presented in the Massachusetts Legislature to fix the maximum rate for electricity furnished by a corporation at 25 per cent above the cost of manufacture and distribution, and the minimum rate at 5 per cent above cost, was held February 8 at Boston. Representatives of labor organizations and of the New England Power League, an association of electrical manufacturers and isolated-plant engineers, advocated the measure on the ground of fairness to the small user of electricity. D. G. Kimball, a Boston operating engineer, claimed the Boston Edison Company made concession in price to former users of private lighting plants, in order to secure the business.

W. P. Barnes, of Worcester, Mass., stated that in his city the Connecticut River Transmission Company sells current for power in 300-horsepower installations or over at 0.625 to 1.25 cents per kilowatt-hour. The Worcester Electric Light Company charges 3 and 4 cents per kilowatt-hour for power.

Arthur M. Huddell, of Boston, pointed out that the Holyoke's city plant charges 1.5 cents for power in quantity and 6 cents for light.

H. M. Comerford, representing the Metal Trades Department of the Power League, held that the Massachusetts Electric Light Commission should make a physical valuation of electric properties. He held that a building corporation in Boston was given a three-cent rate for current used on the three lower floors, the energy being resold by the corporation to its tenants at the 10-cent rate, which the tenants of the floors above paid directly to the Edison Company for current consumed by them.

John H. Carter, of Boston, said physical valuation is bound to come eventually. He praised the work of the Electric Light Commission, which has reported in favor of reducing prices in about 90 per cent of the cases it has considered.

Everett W. Burdett, for the Massachusetts Electric Lighting Association, representing about $50,000,000 investment, opposed the bill. He said the experiment suggested might destroy or impair a large part of the capital now in lighting companies.

The whole question of differential rates, he said, is based on long experience and study by experts, both in the United States and in Europe. Such rates are universal.

These rates are not applied to individuals as individuals, but are based on the character of use of the energy. Mere bulk of supply does not constitute a reason in law for varying prices. The governing factor in price-making is length of time of use of the plant involved. This basis is even more evident in the making of railroad, telephone and express rates. Here it is not the cost of service rendered, but the capital involved that is the prime factor.

The principal element of cost in the business of electricity supply is the investment charges, which bear a relation to the manufacturing cost in the ratio of 7 or 10 to 1. The long-time user is granted the best price because his is the most advantageous use from the company's standpoint. Power rates are lower than lighting, because of the greater diversity-factor and longer daily use.

It is not true, said Mr. Burdett, that companies realize their profits from small consumers. The large consumers at low rates are often vastly more profitable. Often residence lines are run at a loss, with a view to future business through the development of the territory.

On the subject of competitive business, the decision in the Worcester case was cited. Competition is recognized as a legitimate reason for difference in price. The Interstate Commerce Commission has said that a company has the right to take on business if it represents some profit, though not at an equivalent profit gained from some other classes of business.

Mr. Burdett cited court decisions in which the principle was set forth that dissimilarity of service warrants a varying scale of prices, and that a railway company is only bound to give the same rate for the same class of service under the same conditions.

Physical valuation of plants is not needed in Massachusetts, Mr. Burdett said. Since the beginning of the industry it has been under public supervision and all securities issued under the Commission's sanction. The attorney recognized the public misunderstanding of the differential-rate principle, but pointed out that lighting companies in the State have published schedules which all customers come under without personal discrimination.

W. Robman Peabody, representing the Turner's Falls Company, held that it would be impossible to determine the "cost" of supplying each individual customer. After the value of power connection with a generating company is the preparedness to meet emergency conditions in the event of failure of power supply from another source. In such a case the party connected would be paying for the readiness to serve on the part of the electric company, though no energy was supplied.

W. H. Lang, representing the Association of Municipal Plants, said it was well nigh impossible to determine the actual cost of current. He opposed the proposition to value the properties and that the Gas and Electric Light Commission should take the initiative and order change in rates without petition. Mr. Lang held that local conditions determine prices charged, and great plants would soon supply local plants because of more economical manufacturing.

Tests of Radioactive Ore on Plant Growth.

H. X. D. Barton-Hart, an electrical experimenter of Pittsford, Vt., reports some interesting experiments with radioactive ore in its relation to plant growth. Taking two plants of the same kind with identical soil, heat, air and sunlight conditions, one of the plants being an inch shorter than the other, he placed in the soil of the latter a glass tube containing about 37.5 grains of the ore. In three weeks the plant had outstripped its fellow by an inch in height.

Again, taking a slip of the first plant, he placed it in a glass of water with a corked tube of ore. The plant grew and blossomed, though it was constantly in the shade. Also, while the water in the glass froze one night, the plant did not freeze. The plant was not an aquatic and ordinarily requires plenty of sunshine and a rich soil.

Another experiment was the suspension of about 15 grains, inclosed in a gelatine capsule, in a window outside which were growing four Madeira vines. The first result noted was the increased growth of all the vines; second, when the plants reached the height of the window ledge where the capsule was located there was an abnormal growth of "tops." Third, the leaves for about four square feet opposite the ore were 33 per cent larger than elsewhere. Most of the time the window was kept closed. In all cases improvement ceased when the ore was removed.

Mr. Barton-Hart suggests that in order to fertilize land and at the same time conserve the use of the ore, portions of it could be planted at three-foot intervals, both ways, in metal tubes or empty cartridge shells. The ore can be bought at about a dollar a pound, and it is claimed the use of 25 pounds per acre of ground would produce results making the expenditure well worth while.

SELECTION AND APPLICATION OF MOTORS.

By Gordon Fox.

The cost of manufacturing any product is made up of interest on investment, cost of material, labor and power and overhead expense. Efficiency in driving the productive machinery has a bearing upon the last three of these five items. A higher rate of output at the same cost lessens unit costs and the rate of output depends to a considerable extent upon the effectiveness of power application. Therefore the question of motor selection is one worthy of the most careful consideration. Too often the data for a drive are roughly approximated and the cheapest motor secured and installed. This is likely to be an expensive procedure.

There are many factors entering every motor-service problem. Each case deserves careful study of all these factors to provide an effective and efficient application rather than a mere "drive." The points to be considered for any installation may be classed under the following headings:

Individual drive or grouping.
Kind of current and voltage.
Power requirements.
Type of motor.
Method of connection.
Importance of specification details.

The question of individual versus group drive is one concerning which much has been written. The advantages generally attributed to individual drive are:

Maximum productive ability through minimum slippage.

Efficiency through minimum transmission loss.

Greatest freedom in location.

Independence, giving increased reliability.

Most effective control.

Ability to eliminate power loss at nonproductive machines.

Compactness, with attendant safety, through elimination of driving mechanism.

Better cleanliness and light.

Convenience.

Group drive has in its favor lower first cost, attained partly because of the diversity-factor, since a smaller connected horsepower may be required in one unit than in many. The question generally resolves itself—do the advantages of individual drive warrant the difference in cost? This question can be intelligently answered only if the cost of both methods be estimated and the value of the individual-drive advantages be set against the margin in costs.

Whether alternating or direct current shall be used is often already determined by available service. If a new plant is to be installed the adaptability of both types of motors is to be considered and the general trend of practice in the particular industry should be given weight. Both alternating and direct-current motors offer fairly parallel service for many requirements, so that the more special drives may be the determining factor. It is cheaper to consider layouts of all feasible systems in advance and to choose the best compromise rather than to make a hasty installation not to the best advantage. The points affecting selection of alternating or direct current are:

Service available.
Breakdown service.
Speed and torque requirements.
Surroundings conditions affecting reliability.
First cost.

The question of kind of current is closely related with the choice of the type of motor, since where available service does not determine, the decision usually rests upon speed-torque requirements, in which the alternating and direct-current types differ. This point is considered further in connection with motor characteristics.

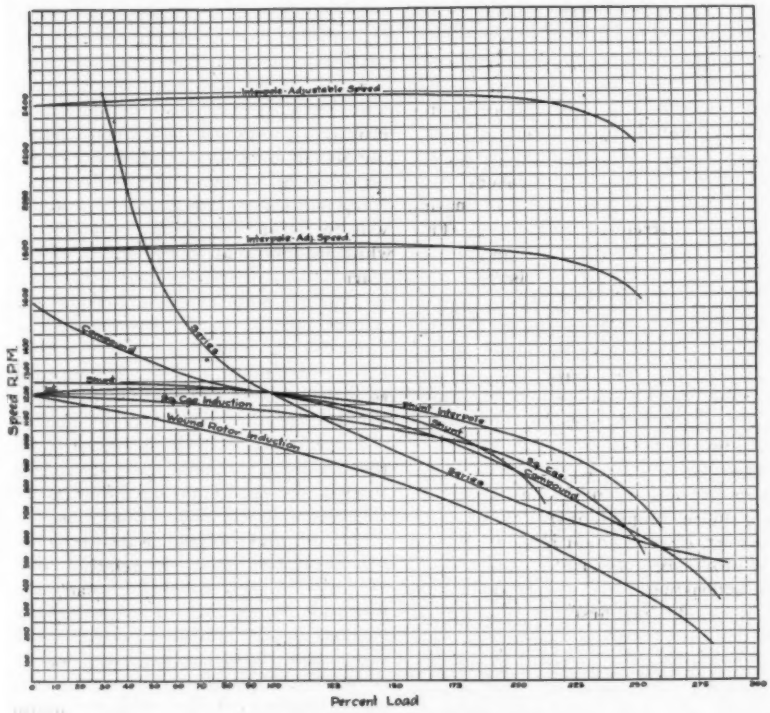
In the matter of reliability the alternating-current motor is to be given preference, since it is more simple in construction, has no troublesome commutator and can withstand overloads and abuse with less disastrous results. Also the first cost of most induction motors is less than that of parallel direct-current motors, due largely to their more simple construction. It is, however, of paramount importance that a motor have the right speed-torque characteristics and it is secondary in most cases that first cost and maintenance cost be a minimum. The margin in effectiveness of drive will more than make up the margin in costs in the majority of cases.

Power requirements include two elements, amount of torque and continuity of its application. Driven machines may require nearly constant torque, as for a printing press, where the load is nearly all frictional, or they may require a torque varying through a repeated cycle as is the case for a reciprocating pump, or the torque may vary irregularly over a wide range as for a rock-crusher drive. The basis for motor selection should be: the maximum torque, the adjustments of the machine affecting the torque, the starting torque and the variety of starting conditions possible. Upon actual machines the torque may be determined by means of levers or ropes attached to the driving shaft. On other machinery, unless data can be secured from the manufacturer or by calculation from mechanical work performed, then the torque can only be estimated in relation to the machine horsepower. Without knowing the actual torques it is possible to consider relative torque and this is really the essential feature. For instance, it is evident that the starting torque of a small band-saw may be made severe in relation to the power required for sawing if the wheels be adjusted for heavy saw tension. It is evident that a brick augur will require an excessive starting power if stopped long enough for the clay to set. Such machines require breakdown or starting torques much higher than full-load torque.

The two limiting features of most motors are torque and heating. We have just mentioned the necessity of determining the maximum torque in order to keep it within the range of the motor selected. The second feature, rate and continuity of power application, determines the heating. Here it is the average heating effect that is important. A swing cut-off saw may require 6 horsepower for 15 seconds while sawing a 2-by-12-inch plank; it will then run idle perhaps 30 seconds while the material is moved; it always starts light; a tight belt or ordinarily dull saw will not greatly increase the power required either to start or run. Therefore a 3-horsepower motor having a maximum torque a little over twice full-load torque will suffice and, since the motor starts light, it may be thrown directly across the line, if of the induction type. This illustration should bring out the necessity of considering not only the horsepower required to drive a machine or perform a process, but also the relative time periods of heavy and light loads and the cycle of action. Most overmotoring is due to a line of reasoning which would say: "It requires 6 horsepower to saw a 2-by-12-inch board, so a 5 horsepower or 7.5-horsepower motor will be needed." Strictly speaking, the square-root-of-means-square load over a representative period determines the heating, but for ordinary work a careful estimate of average load is as accurate as the data upon which it is based.

It is not good practice to motor a machine for maximum service only occasionally demanded, provided a lesser rating better fitting ordinary conditions has sufficient reserve torque to carry the peak. Most motors are rated for 35 degrees centigrade rise, but a 60-degree rise is allowable under ordinary conditions before temperatures injurious to the insulations are reached. A planer taking a one-eighth-inch cut may require 10 horsepower and a 10-horsepower motor will run merely warm in handling this service. At

times it is necessary to take a heavier cut requiring 15 to 20 horsepower. A 10-horsepower motor having sufficient torque will still drive the machine, at slightly reduced speed and at a higher temperature, but so long as an injurious heat is not reached no harm is done. There is a greater range than is ordinarily believed between rated load and maximum safe carrying capacity for a short period. The writer, in making some tests of power requirements, at one time handled a 125-horsepower load for 15 to 20-minute periods with a 35-horsepower motor and subsequent examination revealed not the slightest injury. Excessive undermotoring is not recommended, but overmotoring is a much more frequent fault. The motor manufacturer leaves a goodly margin in his design for a safety factor and it is not necessary to introduce a further factor in estimating the drive.



Typical Speed Curves of Motors.

The power required and its variations, the torque demanded and its limitations, and the relation of speed to torque are the points determining the type of motor. Typical speed-load curves of all the ordinary commercial types of motors are shown herewith, all the curves being for motors of the same rating. A study of these curves will show better than words the relations of speed, load and break-down capacity for the different motor types.

Individual machines of course vary considerably, but the general characteristics are similar. Briefly summarizing; the direct-current shunt motor and alternating-current squirrel-cage induction motor are similar constant-speed types; the compound-wound direct-current motor and the alternating-current squirrel-cage high-resistance-rotor motor are fairly constant-speed types having poor speed regulation and heavy overload and starting torques. The direct-current shunt interpole motor and multispeed induction motor are adjustable in speed, having fairly constant rotation at any given controller position. The series motor is the nearest approach to an inverse speed-torque characteristic, while the alternating-current wound-rotor motor is similar to a heavily compounded direct-current motor with series armature-control resistance, being limited both in maximum speed and maximum torque, the values changing somewhat inversely within the operating range.

Shunt-wound direct-current motors and squirrel-cage alternating-current motors are used for the majority of ordinary constant-speed drives. Shunt interpole direct-current motors are used almost exclusively for adjustable speed work such as for machine tools. The multispeed induction motor affords at best but two or three fixed speeds widely differing, so that its field of usefulness is limited. The compound-wound direct-current motor is used extensively for irregular torque drives, such as for air compressors, and also for drives requiring heavy starting or maximum torques. Compound-wound motors are also best upon variable voltage circuits, such as railway feeder service. The high-resistance squirrel-cage-rotor motor performs similarly to the direct-current compound motor but is not used as much as it might well be. This is perhaps partly due to trouble occurring in many motors of this type at the end rings of the rotor due to overheating. With the introduction of the welded ring the use of high-resistance rotors should become more common. The series direct-current motor is a traction type and is used largely for hoists, cranes and similar service requiring very high starting torques and lesser running torque. The alternating-current wound-rotor motor is used where alternating current only is available for heavy irregular-torque service such as would demand the use of series or heavily compounded direct-current motors.

Motors are connected to the driven machines through the use of belts, gears, couplings, silent or link chains or a combination of two or more means. Belts are more flexible in application and are usually the cheapest drive. Gears are used where wide ratios are desired or where compactness is necessary. Direct-connected motors using solid or flexible couplings are to be strongly recommended for many more drives than present practice indicates. Usually the cost of this type of drive is somewhat higher than that of a belt drive since the motor speed must be the same as that of the driven machine, usually entailing slower speed and more expensive motors. The margin between belt and coupling cost partly compensates for this. The use of direct-connected motors for woodworking machinery should become more general, particularly for high-speed planers, jointers, etc., where a 3,600 revolution-per-minute induction motor, low in cost and high in efficiency, will drive without slippage. Another drive which is not used as much as it worthiness warrants is that using a belt with idler pulley on the motor. This drive is positive, permits wide speed ratios and high-speed motors; the belt centers may be close, thus affording compactness, and the saving in belting pays for the idler attachment. The fact that this type of motor is not usually stocked by manufacturers and distributors is no doubt partly responsible for its infrequent use. Gear and chain drives are too familiar to require comment. A word may be said in regard to gear alinement. A gear drive re-

quires positive, accurate and permanent alinement. For good gear drives the motor should be virtually a part of the driven machine. Too often it is merely an adjunct insecurely mounted. A mounting satisfactory for belt drive may be very poor for gear driving.

We all know that there is a great difference in horses, but do not realize that there is also a difference in motors which furnish horsepower. A carriage horse hitched to a coal wagon would soon break down; on the other hand a heavy dray horse would be a poor investment on a laundry wagon. Fitting motors to machines is much like fitting horses to wagons, except that the faults are not always so evident in the case of motors. The differences in effectiveness and cost exist just as surely in the one case as in the other.

Two essentials bearing upon the perfection of a motor drive but little considered are first, the importance of exact speed and speed regulation, and second, efficiency. Most productive machines are more productive at one speed than at another, particularly if they be power-fed or automatic. Common sense then dictates that in the great majority of cases the running speed should be very close to this most effective speed. In a great many drives an approximation within 10 per cent of the machine-manufacturer's speed is allowed to suffice. Where speed affects production the best speed for each machine should be carefully determined, the exact belt or gear ratios should be figured, special pulleys obtained if necessary, and motors should be purchased which will run at rated speed under prevailing conditions. The motor's speed regulation is sometimes important. Some motors fall off in speed 5 to 10 per cent from no load to full load; others may maintain practically perfect uniformity. A shunt interpole motor may be adjusted for equal no-load and full-load speeds. Why use a plain shunt motor having a five-per-cent drop in speed if that five-per-cent drop means five per cent less production? Motor manufacturers do not guarantee accurate speeds; five per cent above or below rating is considered passable. A motor may run five per cent slower when cold than when hot; thus 10 per cent below speed is quite possible. If this means 10 per cent loss of production it may mean poor economy. After motors are installed it is worth while to check the machine speeds; if necessary, to modify the pulleys or to install a small rheostat in the shunt field to raise the speed when low. If speed maintenance is highly important for maximum production a tachometer is an excellent investment. If motors are provided to drive machines at a certain speed it is well to see that they actually accomplish their purpose rather than approximate it.

Another detail often overlooked is that of efficiency. Motors operate more efficiently when fully loaded than when partly loaded; induction motors of the higher speeds are more efficient than those of lower speeds; one make of motor is more efficient than another. The difference between a mediocre layout and one carefully selected after comparison of data may easily be three per cent and will usually be much more than this. If a plant pays $25 per day for power, a difference of three per cent means $225 per annum of 300 days. Hence it is evident that it is well worth while to obtain efficiency data from motor manufacturers, to consider it carefully with a view to the case in hand and to make a rational selection rather than a guess.

Another angle from which the same question may be viewed is outlined.

Two five-horsepower motors have efficiencies of 83 per cent and 87 per cent, respectively, under the loads they will carry in service. At 30-per-cent load-factor on a basis of 300 days per annum in service and with power at three cents per kilowatt-hour, the difference in power consumption in one year is $4.05. The more efficient motor costs $3.00 more than the less efficient one. Which is the better to buy, other things being equal?

The matter of power-factor is probably less important than that of efficiency, but in some cases it has material bearing. If power is purchased it matters little to the consumer what the power-factor be, but if the power is generated the power-factor affects directly the voltage regulation and even the necessary installed generating equipment. Generators and transformers are now uniformly rated in kilovolt-amperes. Actual power output is measured in kilowatts. The higher ratio of kilowatt to kilovolt-amperes the smaller may be the generators for a given mechanical load. Lagging power-factor has a very detrimental effect upon voltage regulation. In some plants having very poor power-factors it is sometimes almost impossible to maintain the voltage properly. The writer has in mind a case in a woodworking plant in which a large number of small lightly loaded motors were installed. When certain of the larger motors were to be started with the plant in service their heavy low-power-factor starting current, added to the already heavily lagging current, would knock the voltage so badly that the motors sometimes refused to start at all.

Department of Commerce Exhibits at the Exposition.

Exhibits of educational and historical interest will be installed at the Panama-Pacific International Exposition by the Department of Commerce. In the Food Products Building will be found a large exhibit by the Bureau of Fisheries, the Palace of Machinery houses an extensive display from the Bureau of Lighthouses, and in the Palace of Liberal Arts will be found exhibits from the Bureaus of Standards, Navigation, Census, Foreign and Domestic Commerce, Coast and Geodetic Survey and other departments.

The exhibit of the Bureau of Standards is planned from an educational rather than exhibition point of view, and experts of the Bureau will be in constant attendance to instruct and explain regarding matters of standards and measurements.

An amateur radio station and a ship radio station which meet all the requirements of the law will be exhibited by the Bureau of Navigation with the assistance and co-operation of the Bureau of Standards, and demonstrations of the use of the Department's inspection instruments will be made to show the method of determining compliance with the law, serving to illustrate the precautions taken by the Government for safety at sea. In addition to this there will be exhibited a typical station such as is found in commercial use today and in contrast thereto a strictly modern equipment, designed by Government experts, with a particular view to demonstrating the application of the latest developments in the art.

One of the principal features of the exhibit of the Coast and Geodetic Survey will be the automatic tide gauge which is to be housed in a suitable pavilion on one of the wharves which face Yacht Harbor. This gauge will be connected electrically with a tide indicator mounted on the exhibition space in the Palace of Liberal Arts and will show thereon the stage of the tide in San Francisco Bay.

New Officers of Radio Engineers Elected.

At the annual meeting of the Institute of Radio Engineers the election of the following officers for 1915 was announced: President, John Stone Stone; vice-president, George W. Pierce; treasurer, Warren F. Hubley; secretary, David Sarnoff; managers, L. W. Austin, John Hays Hammond, Jr., Robert H. Marriott, Guy Hill, George S. 1 avis and Roy A. Weagant. Alfred N. Goldsmith continues as editor of publications, and three additional managers from the New York membership are to be appointed by the Board of Directors.

The Outlook in the Electrical Industry.

A Very General Feeling That the Tide Has Turned.

Recently the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN requested information for publication from a number of well known manufacturers, representing the various branches in the electrical industry, respecting the business outlook for 1915. The direct question was as follows:

"Does January business and volume of inquiries indicate improvement of January over December?"

The answers as a whole indicated a most encouraging improvement, although not yet all that is desired. It is truly evident, however, as was stated by Mr. James H. Farrell, president of the United States Steel Corporation, in an address on February 8 at Pittsburgh, that the "tide has turned; each day sees a marked improvement in the general situation."

We now publish the answers in alphabetical order in the belief that the optimism expressed is being substantiated and that a steady and continuing confidence in the business outlook is assured:

From ADAPTi Manufacturing Company.

Cleveland, O., February 3, 1915.

Volume of January business is in excess of December. Not many inquiries received for future delivery. Practically all inquiries are followed by orders for immediate shipment. Building prospects for spring in this territory look very bright, but a great many deals are still far from being closed up.

ADAPTi Manufacturing Company.

From the Allis-Chalmers Manufacturing Company.

Milwaukee, Wis., February 3, 1915.

Volume business and inquiries compared with December are practically the same. General conditions we believe improving. Prices advancing on some commodities. We are more optimistic.

Allis-Chalmers Manufacturing Company.

From American Conduit Manufacturing Company.

Pittsburgh, Pa., February 3, 1915.

Slight improvement in January business over December, and an increasing number of inquiries.

American Conduit Manufacturing Company.

From Chelten Electric Company.

Philadelphia, Pa., February 4, 1915.

Pleased to advise that January business was 35 per cent over December business and 10 per cent better than January of last year. We are very optimistic and feel that outlook for coming year is unusually bright. Number of inquiries unusually large.

Chelten Electric Company.

From Cook Pottery Company.

Trenton, N. J., February 4, 1915.

Increased volume of orders, though small; aggregate materially better than October, November and December.

Cook Pottery Company.

From the President of the Cutter Company.

Philadelphia, Pa., February 3, 1915.

Politicians are still rocking the boat and business continues spotty, but orders and inquiries indicate improvement.

A. Edward Newton.

From the Vice-President and General Manager, Cutler-Hammer Manufacturing Company.

Milwaukee, Wis., February 3, 1915.

January business and live inquiries show considerable improvement over December.

A. W. Berresford.

From the Duncan Electric Manufacturing Company.

Lafayette, Ind., February 3, 1915.

Orders received for January were 25 per cent less than December; the business for January, 1914, was exactly 25 per cent less than December, 1913; so this being the case we rather look for business to continue as it has been and which was decidedly satisfactory.

Duncan Electric Manufacturing Company.

From the Morgan Crucible Company.

New York, N. Y., February 3, 1915.

January business very encouraging, being about 40 per cent increase over December. February inquiries and orders most encouraging. Consider situation improving daily.

Morgan Crucible Company.

From the National Metal Molding Company.

Pittsburgh, Pa., February 3, 1915.

January business shows slight increase over last December. General prospects for improvement encouraging.

National Metal Molding Company.

From the Ohio Brass Company.

Mansfield, O., February 3, 1915.

Yes; January business and volume of inquiries do indicate improvement of January over December.

Ohio Brass Company.

From the Pittsburgh Transformer Company.

Pittsburgh, Pa., February 3, 1915.

We find both inquiries and orders have improved during the month of January over December, and we have no complaint to make of general business conditions so far as it has affected our business.

Pittsburgh Transformer Company.

From the Safety Insulated Wire and Cable Company.

New York, N. Y., February 3, 1915.

December and January business taken together show indications of improvement. New business these months, while comparing favorably with same months preceding year, still below normal. January inquiries numerous but few for large amounts.

The Safety Insulated Wire and Cable Company.

From Simplex Wire and Cable Company.

Boston, Mass., February 3, 1915.

January did not show improvement over December in business actually closed, nor in possibilities as evidenced by inquiries.

Simplex Wire and Cable Company.

From the Trumbull-Vanderpoel Electric Manufacturing Company.

Bantam, Conn., February 3, 1915.

Business in early part of January very slow and few inquiries. Picked up considerably the latter part of Janu-

ary, with quite a few inquiries. Volume of business did not equal December, but indications are now that February will beat either December or January in volume of business.

Trumbull-Vanderpool Electric Manufacturing Company.

From the President of the Westinghouse Electric and Manufacturing Company.

East Pittsburgh, Pa., Feb. 3, 1915.

Volume of inquiries decidedly improved in January over December. We look for greater improvement in spring months.

E. M. Herr.

From the President of the Wagner Electric Manufacturing Company.

St. Louis, Mo., February 4, 1915.

We note distinctly improved tone in general situation promising early and substantial gain in sales volume. Our inquiries indicate, however, actual present conditions only slightly better than during December. The best element of the situation is a growing spirit of optimism and determination to go ahead as far as possible, irrespective of adverse conditions.

W. A. Layman.

From the Western Conduit Company.

Youngstown, O., February 3, 1915.

January specifications a little better than December, but not very noticeable. Inquiries are better and for larger tonnage than last quarter last year.

The Western Conduit Company.

Thomas A. Edison's Sixty-eighth Birthday.

Thursday, February 11, was quietly but fittingly celebrated by the employees of the Edison Storage Battery Company, Thomas A. Edison, Incorporated, and other Edison companies as the sixty-eighth birthday of Mr. Edison by wearing the button reproduced in the accompanying illustration.

Tips, the Chronicle of Edison Events, one of the Edison house organs, published an interesting study of the man, Edison, on his birthday, when one naturally looked for the signs of depression after the experience of the past two months, and found only buoyant enthusiasm. It said: "The poise and infinite patience of the trained scientist, who looks at all reasonable problems as only delayed accomplishments, is now Edison's safeguard from worriment and discouragement. The rapid 'come-back' of our industries is actually adding zest to his life and making his birthday a time for honest congratulations, both for his business acumen and courage and for his bodily health.

"What our shops are doing in every industry is plotted on Mr. Edison's progress boards. Everything must come through—from tools to stock—or it shows up on the boards. They are the time tables of the delivery express. They keep Edison cool and patient, like an engine driver, making his stations on schedule, sure of the power and control under his hand.

"But the real, perennial secret of Edison's strong mind and body, *Tips* believes, is found in his 'tomorrow' attitude. With him today is tomorrow in the embryo, tradition is twaddle, and the past is only useful in discovering ways for the future. So when that pesky blaze caused us all some inconvenience there is no doubt about it that Edison found in the reconstruction something that was new, big, creative and worth while to engage his inexhaustible energies."

Mr. Edison was the recipient of many

Badge Worn by Employees of Edison Organizations on Inventor's Birthday.

congratulations sent by friends and electrical organizations in all parts of the country, who rejoiced that advancing age has not detracted from his vigor nor checked his creative spirit.

Chicago Vehicle Meeting.

At the meeting of the Chicago Section of the Electric Vehicle Association of America, held on February 16, J. T. Hartley, of the Sangamo Electric Company, gave a talk on "Ampere-Hour Meters for Electric Vehicles." Mr. Hartley interestingly described the design and construction of the ampere-hour meter, which is of the mercury-motor type, and described its operation. While of benefit in charging batteries, the vehicle-type ampere-hour meter is of particular value in checking the discharge of the battery.

Mr. Hartley also referred to watt-hour meters for use on individual charging circuits, and advocated the use of these meters in preference to making a flat-rate charge for garage service.

Storage Batteries for Radio Service.

M. R. Hutchison, chief engineer of the Edison Storage Battery Company, on February 8 delivered at the Custom House, New York City, a lecture on the use of Edison storage batteries for various purposes and in particular in connection with wireless telegraphy on ships. A large part of the audience was made up of wireless operators and engineers of various coastwise and transatlantic steamers lying at present in the harbor of New York.

The lecture was semi-technical and general in nature, so that all in the audience could readily follow it. By the use of lantern slides and apparatus, the various features of wireless equipment were demonstrated. Attention was called to the great variety of purposes to which storage batteries could be adapted. However, the principal feature of this address was the use of the storage battery in connection with wireless apparatus for ocean-going steamers, using the current simultaneously for emergency lights on deck and passage ways. While, in some instances, the motive power for the wireless apparatus is produced by steam or combustion engines, attention was called to the fact that the starting up of such prime movers would consume considerable time, which might, in case of distress calls, be of the greatest handicap. As has been demonstrated with several steamship accidents, it is of the utmost importance to have the entire plant ready at a moment's notice. The electric storage battery is always ready, and does not need a skilled attendant. The wireless operator throws a switch and the plant is in service. Starting up a steam engine or an oil engine must consume time, at least several minutes.

After Mr. Hutchison delivered this lecture, George S. Davies gave an account of the wireless system operating on ships of the United Fruit Company. During the summer of 1913, this company installed storage batteries on each of its boats sufficient to operate a two-kilowatt radio equipment, which at the same time furnishes current for the emergency lamps on the decks and in the vicinity of life boats, a total of from 25 to 30 lamps. The capacity of the storage batteries is sufficient to operate 12 to 13 hours with a range of communication of 250 miles, under average atmospheric conditions, and under full power for a period of 7 hours, permitting a range of communication of about 500 miles. This equipment is capable of handling ordinary business on trips of 21 days.

Mr. Hutchison, by means of the lantern slides, showed also the manufacturing process of complete storage batteries from the inception to the delivery as a finished product.

LETTERS TO THE EDITOR.

One of the Hazards in Concentric Wire.

To the Editor:

One of the principal claims made for concentric wiring by those advocating its early adoption, is built around the excellent protection its use is said to afford both life and property—with particular reference to the former.

While it is probably true that this claim would prove up in an installation made in strict accordance with proper rules and under the careful supervision of an inspection department, it is most certainly true, on the other hand, that a concentric system improperly installed and without proper inspection would enormously increase the present life and property hazard and it is the writer's desire to direct attention to the fact that a vast amount of concentric would surely be so installed in the event of its adoption.

As is well known to everyone familiar with field conditions, a tremendous volume of wiring is being done at present without regard to the Code and, in many instances, in direct violation of its most important requirements. It is also well known that this condition exists in towns and cities where rigid inspection is maintained by either municipal, underwriter or central-station authorities, or by all three, to as great if not a greater extent as in localities where no inspection exists, for the bulk of this work is done by the household "scissors electrician" and is in the nature of alterations, extensions, repairs, etc., for which no successful method of forcing inspection has ever been, or probably ever will be, devised.

Striking testimony of the magnitude of this class of work is presented by the well organized and well placed retail counters which may now be found in almost any department store, large hardware store and even in many five-cent and 10-cent stores, where short lengths of wire or lamp cord, sockets, receptacles, rosettes, fuses and the like are attractively arranged in convenient packages. Moreover, this class of business has grown to such attractive proportions that many of the electrical jobbers are establishing retail stores on the prominent thoroughfares in an effort to reach the public and obtain their share of it.

In addition to this work by the householder there are a vast number of uninspected jobs done by engineers and electricians of large manufacturing and mercantile properties; by janitors and handymen in apartments and all manner of similar buildings; by the small contractor who never reports his work if it is possible to avoid it and by countless other classes of mechanics who attempt to fatten their earnings by evening and spare-time wiring.

Then, too, there are the hundreds upon hundreds of towns and villages which an inspector rarely if ever visits. It has been reliably estimated that less than 50 per cent of the United States is at present under more or less regular inspection and a check made in several typical inspection territories has shown that only 50 per cent to 70 per cent of the connected sockets in a given locality have been reported for inspection at the time of installation.

The outline of "uncontrolled" conditions given above is in no sense overdrawn or is it based upon conjecture or theory. It is a plain statement of fact as will be attested by any person having a knowledge of actual field conditions. That it has not been responsible for more damage to life and property is due, in the writer's opinion, to the fact that the only materials and devices thus far available have been of "approved" or "standard" type, in which a good margin of safety is provided. By which is meant that the insulation of wire, lamp cord, sockets, snap switches and the like is uniformly good enough and their construction sufficiently rugged to withstand a good deal of abuse at the hands of unskilled, inexperienced amateur electricians.

But what would be the result of placing concentric wire and its fittings within reach of the class responsible for this vast amount of "uncontrolled" wiring,—for, if it can be manufactured and sold at as low a cost as its advocates claim, it most certainly would soon become a "leader" on the counters of the department, hardware and five and 10-cent stores.

In considering this grave question the following points must be borne in mind:

(1) That it is not necessary to ground concentric wire to obtain results.

(2) That is is much cheaper and easier not to ground it.

(3) That the two above points being true, it is absolutely certain that little if any of it would be grounded by persons doing "uncontrolled" wiring.

(4) That a bare, ungrounded conductor carrying 110 volts, alternating-current and often within easy reach, must be considered a serious menace to property and, in many instances, to life.

In fact, when viewed from this angle, the very real danger of adopting concentric systems for use in the United States looms to such huge proportions that we can only believe its advocates have been lead to favor it through mentally applying it to more or less idealized conditions and allowing themselves to be carried away by the picture thus obtained.

Fortunately, however, the Electric Committee of the National Fire Protection Association has always studied proposed Code changes from all angles, with a view to working for a consistent margin of safety on the job where inspection is either not procurable or is purposely avoided, as well as for the job under the close supervision of some inspection department, hence the great danger of placing concentric wire and fittings within reach of the general public will undoubtedly receive careful consideration at their hands.

Those favoring concentric will probably reply to the points raised in this article by pointing to the more or less successful use of concentric wire in certain parts of Europe. This does not constitute an answer, in the writer's opinion, for, while it is true that "human nature is the same the world over," it is equally true that the average American citizen has an impatient, inborn disregard for rules or regulations which he can construe as attempted interference with the manner in which he conducts the details of his home or office, that is widely at variance with the bred-in-the-bone respect accorded similar rules by most of his European brethren.

We can no more hope to legislate the danger out of concentric where the average American citizen with both his "rights" and the need of a light in his coal bin jointly in mind, is concerned, than we can hope to import the famous German "Verboten" and expect to see it as religiously observed as it is in the realm of the Kaiser.

C. W. Abbott,
American Conduit Manufacturing Company.

Pittsburgh, February 15.

The Proposed System of Wiring.

To the Editor:

The proposed Stannos or concentric wiring system presents important problems affecting not only the hazards of life and fire, but if adopted, bids fair to seriously disturb many lines of manufacture.

As to the merits of the system, it would be difficult at this time to deal very specifically with this, as nothing definite has yet been proposed.

The proposed system presents three probable sources of danger to life and property:

(1) Danger of electric shock, due to personal contact with the bare conductor of a supposedly grounded system where the ground connection has been omitted or improperly made, and where the central conductor has become accidently grounded or where the continuity of the return conductor has been broken.

(2) Danger of fire, due to poor con-

nections between adjacent lengths of return conductor, cracks around the conductor where kinked or otherwise damaged, or by short-circuits caused by accidental damage of insulation, due to light wall of conductor.

(3) Danger to iron structures and piping systems, due to electrolytic action.

If the return conductor, which in most cases would be exposed, is properly installed with all joints and grounds properly made, the danger from shock would be less than in the present system, but if a wireman failed to make the ground connection, or made it improperly, the danger to life would be greatly increased. The fire hazard, involving the life hazard as well, would be confined more largely to the wire itself and the wiring connections, and this would naturally depend much upon the character of the return conductor and the means provided for making connections with same.

There is in our mind considerable danger in the use of the proposed concentric wire in which the return conductor consists of a light copper tube surrounding the insulation. It is only natural to suppose that in practice this wire would receive a good many kinks in being handled, and that these kinks would be straightened out by the wiremen, and the wire installed without close inspection to see whether this conductor was cracked at the point where it had been bruised or kinked, and if suspended by staples or held by nails, as would sometimes be the case, some of these weak places would be likely to open up, due to vibration, and cause an imperfect contact, resulting in an arc, with the danger of starting fire or at least destroying the wire. Setting a staple too tight might often partially cut the conductor, or a misblow of the hammer might seriously damage same. In many cases there would be no means of replacing the wire, if plastered in or concealed, as has been advocated. It would be impossible for an inspector to know that the wires were not run in perfectly good condition, as such defects only show up after being in use for some time.

The question of electrolysis is one that should receive careful consideration by those competent of judging on such matters. It would appear to us that the ground return system would inevitably increase the trouble from this source.

It should not be forgotten that the more simple the installation of a system, the more likelihood there is of it being installed by inexperienced people, and in spite of any restrictions which may be placed upon the installation of such a system in the early stages or at any future time, so long as the goods are on the market and are cheaper than devices previously used, they will be purchased and installed by the public without regard for rules.

Is it not almost certain that in a great many cases extensions of concentric wire and fittings will be made in existing ungrounded installations and many new circuits run without any attempt to ground? The flexibility of the wire would suggest to the amateur, as well as the electrician, the convenience of running it concealed as a fishing proposition. In our judgment the use of this system, if once introduced, cannot be controlled, and, therefore, if unsafe for concealed work it should not be placed on the market.

The concerns that would be most likely to be detrimentally affected by the adoption of such a system appear to be numerous manufacturers of wire and electrical and mechanical devices used in wiring and lighting systems. Some of these manufacturers would, temporarily, at least, be affected greatly.

The disposition of the manufacturers generally appears to be to have the system thoroughly studied and considered to determine whether or not it is a real advance in the art before it is permitted to be put into service to any extent, and that such consideration, in order to be effective, should extend over a considerable period of time, and should it then be proven to be a reliable and desirable system, due public notice should be given by the Underwriters as to when approval should go into effect, giving ample time for the manufacturers who would be affected by such a radical departure from present standards to adjust their business to the new conditions. In our judgment such careful consideration would require approximately two years' time, and if passed upon favorably by the Electrical Committee of the Underwriters', another year's time should be given manufacturers in which to prepare for the change.

If this system should be adopted, it would seem proper to place the responsibility for making proper ground connections upon the central station, and in order to eliminate, as far as possible, the danger to life due to the unauthorized use of concentric wire, it would appear desirable that all circuits in all buildings be thoroughly grounded and solidly connected without any fuses in the return conductors. This would be equivalent to grounding the secondaries of all transformers.

The use of this system would require a large line of new fittings, which would replace very many of those now in the market. Insulating joints for sible to pull in and replace burned-out lined sockets would be replaced with cheaper forms; present forms of outlet boxes would yield to more convenient forms; fuse boxes and panel boards would become single-pole, with no fuses for neutral.

It has been stated by the advocates of the concentric system that they are not necessarily working for the adoption of this particular system, but for some system that will cheapen the cost of installation and thereby make it possible for the central stations to obtain a large increase in load by obtaining customers who are unable to pay the present price for wiring their buildings. It occurs to us that in view of the fact that the cost of installation is a small item, as compared with the cost of current and charges often made by central stations for bringing the service to the buildings, unless some suitable reduction in said rates is provided the new system will not bring the results desired.

Assuming that it is safe to adopt grounded systems, would it not be safer and disturb present conditions less to use rigid or flexible-steel conduit in smaller sizes (one-quarter-inch or three-eighths-inch) and a single conductor corresponding to the present No. 14 rubber-covered wire used for conduit purposes, thus making it possible to pull in and replace burned out wires where concealed, at the same time giving proper protection to the wire by means of the heavier return conductor in the form of flexible or rigid conduit. A flexible conduit would serve practically all purposes for exposed work for channeling in plaster and fishing through partitions, etc., without danger of becoming kinked in the process of installing. This would not disturb the manufacturer of wire to a very great extent, and would admit of the continuance of the use of outlet boxes, condulets, unilets and a great variety of fittings of this character, with the addition of suitable means for electrically connecting the various runs together, grounding fixtures, etc.

While this system might not be as cheap as the concentric wire, it would in our judgment be far safer and should be considerably cheaper than the present system.

R. B. Benjamin,
President Benjamin Electric Manufacturing Company.
Chicago, February 15.

Illuminating Engineering Society.

At a meeting of the Council of the Illuminating Engineering Society held February 11, the Committee on Time and Place recommended that the 1915 convention of the Society be held in Washington, D. C., during the third or fourth week of September.

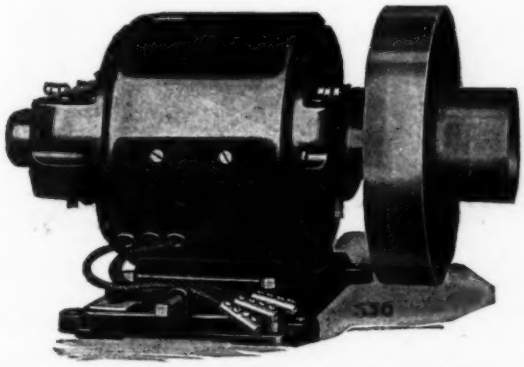
New Electrical and Mechanical Appliances

New Steel-Frame Direct-Current Generator.

The illustration herewith shows a new generator recently introduced by the Robbins & Myers Company, Springfield, O. This generator has a cast-steel frame, which makes a light, compact construction, and is made in capacities ranging from 0.25 to 1.5 kilowatts.

These machines are furnished in low voltages for charging storage batteries, as well as in the higher voltages, and are particularly suitable for farm lighting plants and similar services. They can be supplied with flywheel pulleys, as shown in the illustration, for gasoline-engine drive.

The bearing bracket on the commutator end is so constructed as to give easy access to the commutator and brushes. The bearings are large and are provided with oil reservoirs of large capacity. They are oil-ring lubricated. The leads are brought out through holes in the frame which are bushed with a high-grade, heat-resisting insulating material. Sliding bases are supplied with adjustment screws for adjusting the belt tension.



Robbins & Myers Steel-Frame Direct-Current Generator.

Automatic Starter for Direct-Current Motors.

The Industrial Controller Company, formerly the Independent Electric Manufacturing Company, Milwaukee, Wis., has recently brought out a new line of automatic starters for direct-current motors, one of which is shown in the accompanying illustration.

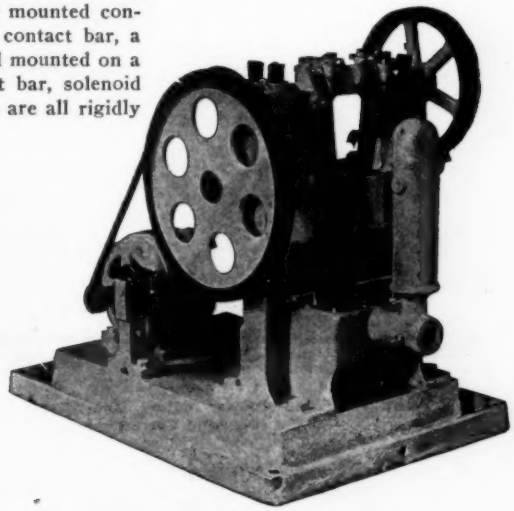
This starter is very simple and rugged in design. It consists essentially of a series of resiliently mounted contact fingers, a movable contact bar, a solenoid and dashpot, all mounted on a slate base. The contact bar, solenoid core and dashpot piston are all rigidly fastened together, forming a single movable part having a simple straight-line motion in a vertical direction. The contact bar is moved upward by the solenoid to start the motor and when released drops quickly by gravity to the "off" position.

The contacts are of the butt type having a slight rubbing action when closing, which tends to keep the contact surfaces clean. Both finger tips and contact bar are renewable and are so designed that in emergencies new parts could be readily made by an ordinary mechanic from commercial sizes of copper and carbon.

The solenoid is entirely inclosed in a cast-iron frame, or housing, to the bottom of which is attached the dashpot cylinder. This construction affords positive alinement between solenoid core and dashpot, and renders the latter easily removable. The dashpot is of the vacuum type with an adjustable air-inlet valve, which controls the time of acceleration. A portion of the vacuum chamber is provided with a bypass, thus permitting the contact bar to jump quickly to the first contact and eliminating the arcing that would otherwise occur.

Acceleration can be varied over a wide range and adjustments made, if desired, while the starter is in operation. These starters are designated as type E, and are suitable for a great variety of applications.

Automatic Direct-Current Starter.



Goulds Motor-Driving House Pump

Motor-Driven House Pump.

The accompanying illustration shows a pump particularly adapted for use on the farm or country estate and in some manufacturing establishments. The outfit requires no attention or care except occasional lubrication. It can be located in an out of the way place and can be easily and safely controlled from a distant point by means of a simple switch.

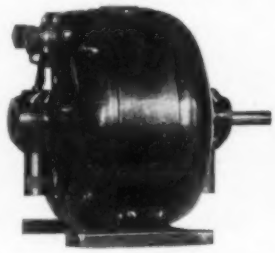
The pump is driven by a one-eighth-horsepower Westinghouse motor, and

will fill a 300-gallon tank located 120 feet above it in less than three hours at a cost of approximately five cents, based on the usual cost of electricity.

This pump is of the triplex type with cylinders 1.25 by 2 inches. The base is 16 by 23 inches. The outfit is manufactured by the Goulds Manufacturing Company, Seneca Falls, N. Y.

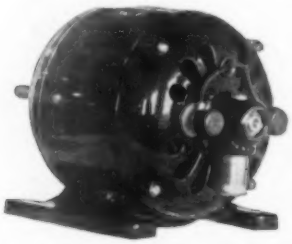
New Diehl Fractional-Horsepower Motors.

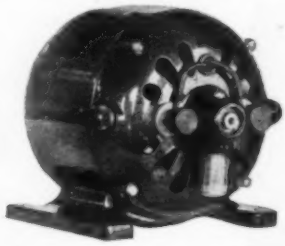
The Diehl Manufacturing Company, Elizabeth, N. J., has designed and placed on the market an entirely new line of fractional-horsepower motors for use on direct and alternating-current circuits.



Two Sizes of New Diehl Fractional-Horsepower Motors, Showing Types of Frame Construction.

The whole line is built for interchangeability between similar direct-current and alternating-current ratings, which gives the user the great advantage of using one design of base, bracket and motor space without regard to the character of current to be used.





Two One-Twenty-Fifth-Horsepower Motors, One Alternating Current and Other Direct Current, Showing Correspondence of Frames.

Mechanically these motors are as light and strong as possible and were designed from a viewpoint of service, attractive appearance and compactness. The motor feet do not project beyond the body lines, are drilled for attachment, and are strong and substantial. The shafts are sufficiently strong to withstand loads far beyond the capacity of the motor.

Oil-return channels in bearings return excess oil to cups, obviate throwing or dripping of oil, and supply a circulating system of lubrication. Ample ventilating space is provided although all moving parts are protected with a view to internal cleanliness with little care or maintenance.

To show the complete interchangeability between frames bearing similar ratings for alternating current and direct current, the manufacturer claims that curves plotted from the performance of a direct-current motor showing characteristics from no load to full load will be practically identical to curves plotted from the performance of an alternating-current motor under similar operating conditions, and vice versa.

The two smaller frames of this new line are rated one-fiftieth and one-twenty-fifth horsepower, respectively, at 1,725 revolutions per minute. These motors have die-cast shells and covers. The larger sizes, up to one-quarter horsepower, are furnished with cast-iron frames and covers.

The Diehl Manufacturing Company states that these motors will develop a starting torque equivalent to not less than 150 per cent of full-load running torque.

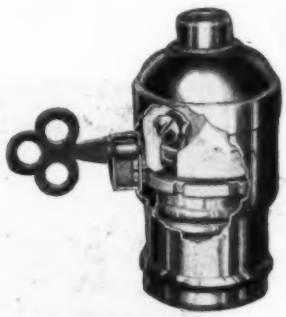
Locking Sockets and Receptacles.

The General Electric Company, Schenectady, N. Y., has recently marketed an improved design of locking sockets and receptacles of both the key and keyless types. These sockets and receptacles afford positive protection to lamps in public or semi-public places, such as hotels, street cars, mills, factories, assembly halls, theaters, school dormitories, etc., where losses of lamp bulbs often occur.

The locking device on the sockets effectually prevents the removal of lamps by unauthorized persons. Lamps can only be inserted and removed by aid of the key, and the improved principle of the design also provides against breakage from tampering. When the key is removed, the screw shell of the socket swivels freely, thereby avoiding injury either to the lamp base or socket if a sudden attempt is made to twist and remove the lamp bulb without the key.

These sockets and receptacles constitute an ideal installation for residence lighting in connection with a system of burglar or emergency lights controlled by master switches located in the bedrooms. Should the necessity suddenly arise, from the sound of an intruder in the house, unexpected illness or other cause, the occupant of any bedroom can turn a convenient switch and flood the entire house with light. Then if the lamps in this circuit are in locked sockets and receptacles, they can neither be turned off nor unscrewed, and if otherwise protected, so that the bulbs cannot readily be broken, they will remain lighted as long as the master switch is closed.

Locking Socket and Key.



Socket with Shell Broken Away to Show Locking Mechanism.

Electromagnetic Piano.

A piano in which the notes are produced by the wires being set in vibration by an electromagnet instead of being struck by hammers, is the invention of two Frenchmen. The mechanism is operated in the usual way by a keyboard, but instead of dying gradually away, as they do with ordinary pianos, the notes maintain their volume as long as the key is pressed. The effect produced is similar to that of an organ, and makes of the piano an entirely new and different instrument.

THE ULTRAUDION DETECTOR FOR UNDAMPED WAVES.

By Lee de Forest.

While the users of the Audion detector are now numbered by the hundreds, very few perhaps understand that by slight modification of circuits, or with certain bulbs, by mere adjustment of the filament-heating current and battery potential, it becomes a detector of undamped wave signals of extraordinary sensitiveness.

The Audion under these conditions becomes a persistent oscillator or generator of continuous oscillations of constant amplitude. The energy thus generated varies from the order of a microwatt in the usual small Audion bulb to tens of watts in bulbs of three inches diameter or larger, consuming two or three amperes of filament current and energized by a B battery potential of several hundred volts.

To an Audion detector bulb in this oscillating condition, the name "Ultraudion" has been applied, as fitly descriptive of the ultra sensitive response which it then gives to incoming received oscillations. Whether these be of undamped or damped characteristics, the sensitiveness of the ordinary Audion (itself generally admitted to be the most sensitive wireless detector yet known) is greatly enhanced by 10 to 50 times, according to the quality of the individual bulb and of the particular circuit combination used.

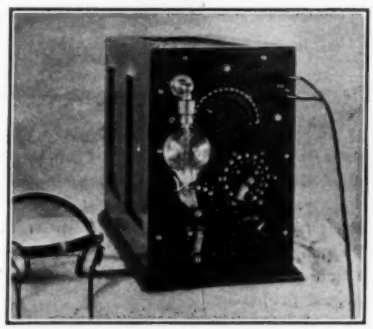
The Ultraudion state was first discovered by the writer when using a bulb connected in the usual manner, with a well designed secondary receiver circuit connected across the grid and filament (standard Audion connection). The filament was heated to an unusual degree, thereby reducing the internal resistance of the bulb, and the capacity of the "stopping" condenser in series with the grid made extremely small, of the order of 0.0001 microfarad. While testing this bulb with an arc transmitter station, I observed that, at a certain adjustment of the filament current and B battery, the customary rough hissing sound due to the irregularities of the arc was suddenly replaced by a faint flute-like whistle. The pitch of this note could be varied at will by varying the condenser in shunt to the secondary of the receiver transformer.

It was at once apparent that here I had a tiny generator of undamped oscillations, the period of which could be controlled within limits by varying the constants of the closed oscillating circuit and, to a certain degree, by the heating current and the B potential.

At a later date when developing the Audion amplifier as a relay for telephone currents and weak wireless signals, I found that with two bulbs connected in cascade[1] this Ultraudion condition could be more readily produced, due to the tendency of the impulses set up in the second Audion to react upon the first, through the coupling transformer or associated circuits.

In fact, the low or audio frequency oscillations thus set up often became a nuisance until special care was taken to neutralize this reactive tendency. Loud siren notes, of pure quality and piercing intensity, were readily obtainable, the pitch of which could be altered in droll effects merely by touching one or another point of the associated circuits with the finger.

If means now were provided for conducting high-frequency oscillations from the first to the second Audion circuit, as for example, by shunting the heavy retardation coil, B batteries, and telephone receivers by small condensers, then when the first Audion and its shunted oscillation circuit were caused to set up high-frequency oscillations, these were amplified in the second



Twelve-Volt Ultraudion.

Audion radio circuits, provided these latter were attuned, or nearly in tune, with those of the first Audion, or with its lower harmonic.

The action of the second Audion is almost invariably to amplify these impressed high-frequency currents, so that in a telephone receiver connected in the usual fashion between the plate and B battery of the second Audion, one hears a beat-note of surprising intensity. The pitch of this note can be run through the entire gamut of audibility from upper audibility down to a low guttural note, then lapsing into inaudibility as the two oscillating circuits are brought into nearly exact resonance, then rising higher and higher as one or the other circuit is again detuned.

The energy represented in this beat-note is many hundred times that of the initial high-frequency energy in either oscillating circuit alone.

[1]For description of the circuits, thus used, see paper "Audion Detector and Amplifier," *Proceedings*, Institute Radio Engineers, March, 1914, or *London Electrician*, November 16, 1913.

Therein lies the principle of the extraordinary sensitiveness of the Ultraudion detector of undamped oscillations. It becomes at once a source of continuous oscillations, a detector of the incoming oscillations, and an amplifier either of these latter in their original frequency or of the beat frequency set up by the interference between these two radio frequency oscillations of slightly differing periodicities.

In the form of Ultraudion circuit most preferred these functions are all performed in one bulb and one oscillating circuit with a small variable condenser in shunt around the B battery and telephone receivers. The Ultraudion bulb itself is preferably of different construction from the ordinary detector Audion, being supplied with double plate and grid elements. However, the Ultraudion effect can be obtained in many single bulbs, particularly if of high vacuum.

The B potential must, however, not be made too large, for it is easy to send the bulb back into the non-oscillating condition. One can easily determine when a bulb is in this Ultraudion state by touching one terminal of the oscillating circuit with the finger. A characteristic "cluck" or scratching sound is then heard in the telephone receiver which is entirely absent when the bulb is not oscillating.

When used as a detector of damped-wave signals the true spark-tone quality is entirely absent, unless these signals are extremely intense. The sound of spark signals takes on instead a hissing, rustling or unclear quality, very similar to those from a rotary "tikker" as used with the Poulsen system.

Thanks to the greatly enhanced sensitiveness of the Ultraudion, these spark signals are now many times louder than when the simple Audion reproduces the true tone quality, a fact which ordinarily gives the Ultraudion a very real advantage even for spark reception. Moreover, an increased immunity from interference from more strongly damped spark stations is afforded. In times of severe static disturbances, however, the advantage of the high clear spark notes and the individuality of the tone quality of a sending station more than compensates for the reduced audibility factor of the simple Audion.

As detectors for undamped oscillations, we have today four types—the Poulsen "tikker," the Goldschmidt "tone-wheel," the Fessenden Hetrodyne and the Ultraudion. The latter combines at once points of simplicity, reliability, sensitiveness, sharpness of tuning, and tonal selectivity, which (I believe it can be stated without fear

of dispute) marks it unique in the field of present-day wireless detectors.

For many months, the United States naval radio station at Arlington, Va., has used the Ultraudion in daily reception of messages from the 50-kilowatt arc station at Honolulu, H. I. At the Bureau of Standards, Washington, D. C., daylight signals are also received from Eilvese, Germany, with several hundred times audibility, using an aerial 150 feet in height. In New York messages from the undamped wave stations at Nauen, Germany, and San Francisco are picked up at almost any hour of the day during the fall and winter on an antenna lying below the level of the highlands on either side of the Harlem River, and always without the slightest interference from any of the powerful stations from New York to Tuckerton and Arlington.

When receiving from arc stations, for example, Newcastle, New Brunswick or San Francisco, both the sending and compensation waves can be heard, if desired, as two clear, flute-like tones, one differing by about a half octave from the other, alternatively as the transmitting key lengthens or shortens the emitted wave. If, however, it is desired to completely silence the compensation "signal" it is necessary merely to attune the period of the receiver circuit to close syntony, with the compensation wave length, when the local circuit is forced into syntonic oscillation therewith and that beat-note disappears. This leaves the signal wave to form a solitary low-pitch beat-note with the Ultraudion's local oscillation.

For high-speed recording of wireless signals the Ultraudion offers great possibilities. In the rapid transmitting and automatic recording system which the writer developed for the Federal Telegraph System between San Francisco and Los Angeles the "tikker" signals were first amplified by a three-step Audion amplifier, and then recorded upon the rapidly travelling steel wire of an American telegraphone. This record was subsequently run off again at a speed one-third to one-fifth that of the original recording speed and the message thereby rendered readable by ear. In this manner wireless messages, tape-punched, have been transmitted commercially at a speed of 60 to 100 words per minute.

The method has proven itself a genuinely practical one. The speed limit imposed, however, was found to be that due to the quality of the "tikker" signals itself. When these signals were reproduced at a speed for ear reading which was less than that above mentioned, their low non-musical quality caused the "dots" to become quite inaudible.

With the Ultraudion detector, however, the pitch of the received signals can be made as high as the telephone diaphragm, or the magnetic lag of the telegraphone wire will permit, say 6,000 per second. This permits a reproduction speed of one-twelfth, with a good readable note of 500 per second, at a speed, say, of 25 words per minute for a speed of transmission of 300 words per minute.

Special Three-Way Busbar Supports.

The Electrical Engineers Equipment Company, Chicago, Ill., has recently supplied to H. M. Byllesby & Company a large number of special three-way bus supports illustrated herewith. This material is to be used on the system of the Minneapolis General Electric Company, which is one of the Byllesby Company's largest properties.

Fig. 1.—Front View of Three-Way Busbar Support.

Of the accompanying illustrations, Figs. 1 and 2, show a front and side view of this support and Fig. 3 shows how they are fitted into the bus structure. The

Fig. 2.—Side and Rear View of Support.

support is designed to insulate 3-inch by 1-inch rectangular busbars for a working pressure of 17,000 volts. The buses are mounted in a vertical plane, as shown in Fig. 3. The top and bottom supports are fastened to two parallel 1.5-inch pipes 90 degrees apart. The middle support is fastened to one 1.5-inch pipe, bolted to and separated from the top and bottom supports by Transite board. Each bus therefore is in a separate compartment.

The chief advantages of this type of construction are low first cost, ease of installation, accessibility to buses and cool operation of same. This arrangement does away with the building of costly concrete or brick bus structures. The busbars are accessible at all times and, owing to the open structure, the undue heating of buses even at large overloads is avoided.

Each of the three porcelain insulators was tested separately after the support was assembled. Each insulator was made to withstand a pressure of 60,000 volts before leaving the factory. These tests were made in the Electrical Engineers Equipment Company's testing laboratory.

The outer clamps are of malleable iron

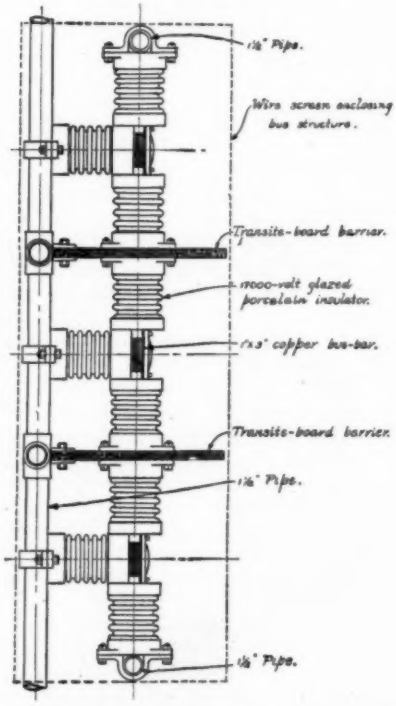


Fig. 3.—Section of Bus Structure, Showing Arrangement of Support.

while those which support the current-carrying parts are of composition metal. All clamps are adjustable throughout 360 degrees.

These supports were designed by the engineering department of the Electrical Engineers Equipment Company working under the direct supervision of the engineers of H. M. Byllesby & Company. This is the second order for this type of support, which shows that it has fulfilled all expectations.

It is said that 72 per cent of the cities and towns in Sweden are lighted by electricity developed from water power.

New Cutter Street-Lighting Fixtures.

One of the oldest and best known firms manufacturing electric lighting fixtures and auxiliary equipment is the George Cutter Company, of South Bend, Ind. For over a quarter of a century the company has devoted itself particularly to the development of street-lighting equipment and throughout its long career has maintained itself a leader in the supply of fixtures and line material to meet the varying requirements created by the many stages in the evolution of the art.

The growing use of incandescent lamps for street lighting, particularly

Fig. 1.

since the development of the high-efficiency gas-filled tungsten lamp, has stimulated the demand for fixtures specially designed to permit the use of these lamps to the best advantage and this need has been promptly met by the George Cutter Company, which has added during the last year many new types of fixtures to its already very extensive line. A few of these will be described in this article.

A distinctive feature that has been kept in mind in the design of these fixtures is interchangeability by the use of standard parts. For example, in the line of street hoods the various types of reflector parts, receptacles for housing the sockets, and suspensions are so arranged that an exceptional variety of selections of different parts

Fig. 2.

is possible, all of which fit together perfectly and make an exceedingly large assortment of complete fixtures to meet every conceivable condition. This idea is also carried out in the larger and more ornamental fixtures. The entire line is therefore fully comprehensive from the simplest to the most elaborate.

One of the simplest designs is that shown in Fig. 1, the inverted-cone street hood. The reflector resembles the frustum of a cone, being so shaped that it directs light into the horizontal direction and angles near this, so as to give the wide distribution necessary with long gaps between units. The hood overlaps the reflector and aids it in confining the light into useful directions. Hoods are of 18 and 22 inches

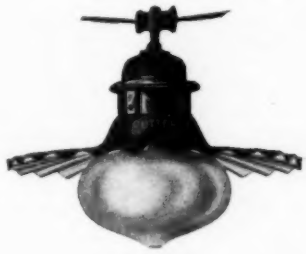


Fig. 3.

diameter, the same reflector being used with both. A hood fork inside the body holds the socket and other parts together. The hood and reflector are made of drawn steel with weatherproof paint enamel or porcelain enamel finish. These fixtures are suitable for

Fig. 4.

lamps from 60 to 250 candlepower and for any type of suspension.

A radial bowl-type reflector street hood is shown in Fig. 2. The porcelain-enameled reflector in this case is 20 inches in diameter and is made with (as shown) or without extension fit-

Fig. 5.

ting into a ventilated iron canopy. This carries a porcelain housing for securing the socket. The fixture shown is especially suitable for 250, 400 and 600-candlepower lamps. This fixture can be arranged for bracket or center-span suspension and provided with diffusing or refracting glassware. Fig. 3 shows one of these fixtures of the cable-grip suspension type equipped with 24-inch radial bowl reflector and acorn diffusing globe. Fig. 4 shows a fixture for similar suspension, but provided with a cable cross-arm and large refracting globe.

Fig. 6.

Fig. 5 shows a fixture with similar canopy and housing, but different reflector. In this case it is a 12-inch extended dome reflector below which is a small refracting globe. This fixture has a simple cross-arm and insulated loop suspension, especially designed for high-voltage series circuits.

Another line of fixtures is typically illustrated by Fig. 6, which is actually a store-lighting fixture that is readily convertible for street lighting. This fixture has a ventilated-copper casing with lamp-grip socket and supporting spindle

Fig. 7.

therefor that is vertically adjustable with respect to the reflector or globe, making the fixture adaptable for all sizes and types of incandescent lamps, including the gas-filled species. The porcelain-enameled reflector is 20 inches in diameter and the globe is an acorn diffuser. This type of fixture is known as the Mazdaarc, since it resembles the arc type but employs Mazda lamps.

Still another line of pendent fixtures is represented by Fig. 7. This shows the Sol-lux Junior design with 18-inch

porcelain-enameled reflector and diffusing globe. The upper part of the casing is cast iron, well ventilated for gas-filled-lamp use. A compensator may be mounted therein, if desired. The lower portion of the casing is of copper. Porcelain bushings are provided for the connecting wires. This type of fixture, with its varied equipment, is especially adapted for use with the larger gas-filled lamps.

Most of the fixtures described above can be used for either series or multiple circuits and in nearly each case with several sizes or types of sockets. For series circuits, however, a special film

Fig. 8.

socket, known as the Regent, has been developed and this has met with much success. Fig. 8 shows one of these sockets complete, except for the supporting fork or other means used for securing it to some types of fixture. Fig. 9 shows the film-holder and mogul-base socket unscrewed from the porcelain receptacle

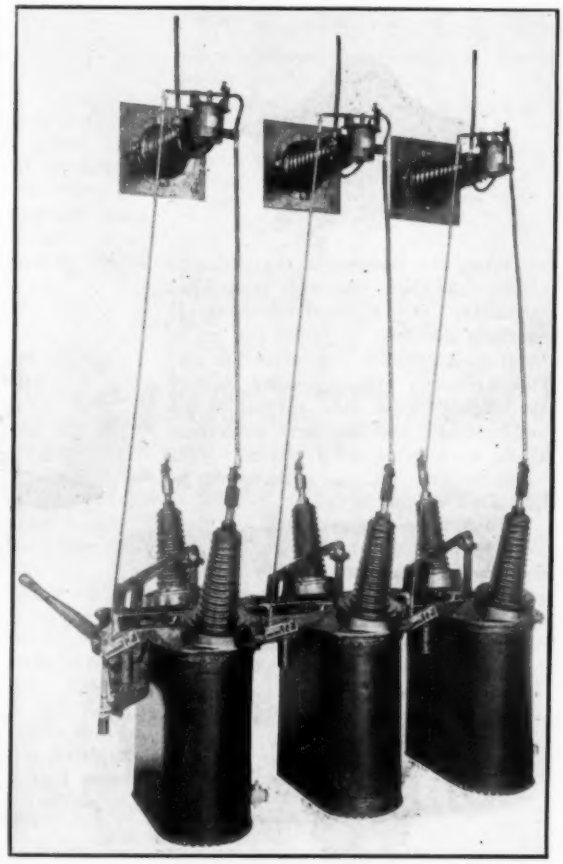
Fig. 9.

part of the device. A special silk-tissue is used as the film cutout; this has been found to puncture accurately and uniformly at its rated voltage. The film is ring-shaped and, although very easily renewed, can not be improperly replaced by any substitutes. The film is entirely inclosed within the porcelain part and thus well protected from moisture, wind or other climatic changes that affect other types of film cutouts. The two screw shells also serve as a lamp grip and prevent lamps from dropping out due to vibration or wind. The entire device is very compact and all live parts are covered.

In the line of ornamental street-lighting equipment the George Cutter Company has steadily added to its numerous designs of cluster and single-unit posts. Of the latter, two new designs are shown in Figs. 10 and 11. The former is known as the Continental design. Its base is 20 inches in diameter and 31 inches high. The height to the top of ventilator is 14 feet 8 inches. The column tapers from 7.5 to 5.75 inches. A compensator can be included in the top for use with 15 or 20-ampere gas-filled lamps. Fig. 11 shows a more slender post for use in lighting parks or boulevards. Both these designs, like the

Figs. 10 and 11.

others of this line of which they are typical, are graceful in outline.



Triple-Pole, 45,000-Volt Oil Switch with Series Trip.

New Series Trip for High-Voltage Oil Switches.

Low-voltage current is usually employed to trip high-voltage automatic oil switches on the occurrence of abnormal conditions against which the automatic features are intended to guard. Electrically operated switches are usually tripped by direct current; for tripping hand-operated switches, alternating current is generally used. In many cases, however, neither low-voltage direct current nor alternating current is conveniently or cheaply available. Then automatic protection is secured by the aid of a high-voltage series trip.

For this service the General Electric Company, Schenectady, N. Y., has developed an arrangement representing considerable improvement on types of high-voltage series tripping devices heretofore in use. The new features are: accessibility of the working parts for inspection, cleaning or adjustment while in service without danger, calibration at the oil switch itself and not at the insulator supporting the series tripping solenoid, and the use of a new type of solenoid, which consists of but a few simple and rugged parts that need practically no attention.

The solenoid plunger is connected to the tripping mechanism of the oil switch by a wooden rod. Calibration, that is, change in current tripping values, is accomplished by a movable weight located near to the operating mechanism of the switch at a considerable distance from the high-voltage current.

This type of series trip is furnished for instantaneous or inverse-time-limit operation. Time delay is obtained by means of a dashpot mounted on the tripping mechanism at the switch.

Current Electrical News

ATLANTIC STATES.

LEE, MASS.—Improved street lighting on Main Street, with more and larger incandescent units, is contemplated. W.

CALDWELL, N. J.—Mayor Cook and borough officials are negotiating with the Public Service Electric Company for the installation of a new street lighting system. A.

JERSEY CITY, N. J.—The William J. Kurfehs Association is negotiating with the city commission for the installation of an improved street-lighting system, forming a "white way" on West Side Avenue, south to Culver Avenue. A.

PERTH, AMBOY, N. J.—The Public Service Electric Company has tendered a proposition to the city officials covering the substitution of the proposed municipal electric lighting plant for improved service to be rendered by the company. The plan includes a reduction in rate, new street-lighting, and underground conduit installation to the extent of $30,000 a year for five years. A.

BATH, PA.—At a mass meeting of the citizens of this borough, it was decided to erect a large modern high-school building. An architect will be chosen shortly and it is expected that construction work will be started in May. It is said that the electrical features of the new building will receive considerable attention.

BETHLEHEM, PA.—At a meeting of the borough council held recently, the recommendation of the light committee that the system of boulevard lighting should be extended, was adopted. The first step in the proposed extensions will be the installation of lighting standards on Main Street between Market and Church. A. F. George is chairman of the light committee of council.

MT. AIRY, MD.—The Mt. Airy Electric Company, of Mt. Airy, Md., has been granted a franchise by the officials of that place to install and operate a system of illumination in the town. C. C. Riddlemoser and R. L. Runkles are sponsers for the venture and will run the electric plant in conjunction with their ice factory, now in operation.

NORTH CENTRAL STATES.

BLUFFTON, O.—The council is planning to spend $17,000 for improvements to the light and water system. Address city clerk.

CINCINNATI, O.—A building to accommodate several commercial garages and a large automobile repair shop is to be constructed by L. B. Reakirt at Fifth and Sycamore. Samuel Hannford & Sons are the architects who are preparing the plans. L.

NEWARK, O.—The city council has been in conference with engineers in the matter of erecting a municipal light plant here. A tentative estimate for the construction of the plant is $30,000.

SALEM, O.—At the invitation of the city authorities, experts have submitted propositions for a municipal lighting plant, the estimate of same being $15,000. J.

SOUTH SOLON, O.—The local authorities, as well as merchants and residents generally, are preparing for the use of electricity, which will be furnished from the lines of the Washington Gas and Electric Company, of Washington C. H. About 60 street lamps, each of 60 candlepower, will be used for street lighting, and a considerable amount of other equipment will be purchased by private parties for the use of electricity for light and power.

MITCHELL, IND.—It is understood that the city is looking for plans to build a new municipal electric lighting plant. The present plant, which was built some 20 years ago, is not large enough to keep up with the increasing demand for energy.

COBDEN, ILL.—The Cobden Light and Power Company has been licensed to incorporate. The capital stock is $5,000, and the company is to sell light and power. The incorporators are I. H. Lawrence, R. H. Lawrence and R. L. Lawrence.

HOYLETON, ILL.—The Hoyleton Electric Light Company has been incorporated with a capital of $5,000. The company is to construct a plant and furnish electric light, heat and power. Incorporators: K. A. Steinhauser, C. A. Steinhauser and E. W. Rixmann.

IOWA FALLS, IA.—The electric light plant has been placed in the hands of a receiver, and A. B. Miller, of Iowa Falls, has taken possession.

CHAPMAN, KAS.—A mass meeting at Chapman recently asked the city council to call an election to vote bonds for a municipal light plant. M.

CONCORDIA, KAS.—It is reported that several towns will make arrangements to get current from the Concordia Electric Light Company. The first contract of the kind made recently is with the city of Clyde, where the plant, owned by James Turner, will be taken over by the Concordia company, and a transmission line will be completed by May 1 for the carrying of current from the Concordia central plant. M.

OTTAWA, KAN.—A bond issue has been proposed by Pomona, 10 miles from Ottawa, to raise $10,000 with which to build service lines to transmit electric current to be bought from the Ottawa plant.

SOUTH CENTRAL STATES.

CORBIN, KY.—The city has sold its $5,000 electric light bonds to Weil, Roth & Company, of Cincinnati, at above par.

CORBIN, KY.—H. E. Hay, of Corbin, is owner of the electric lighting and power franchise just sold by the town of Irvine, Ky. The franchise requires that work shall be begun on the system inside six months, but that the owner expects to begin immediately.

LOUISVILLE, KY.—The Board of Education is considering bids for electrical supplies to be used at the Prevocational School.

NEW HAVEN, KY.—The town authiorities have taken an option on the B. D. Florence & Son mill as a location for the electric light plant.

WILLIAMSBURG, KY.—The council has approved the plan proposed by Manager A. C. Mahan, of the Williamsburg Light and Power Company to light Main and Depot Streets with new 300-candlepower lamps.

WINCHESTER, KY.—J. D. Sousley has been awarded the contract for wiring the new Paris, Ky., $50,000 Y. M. C. A. building.

BRISTOL, TENN.-VA.—Severe requirements which the city council of Bristol, Va., which has a separate corporate existence from Bristol, Tenn., seeks to exact may, it is said, cause the company to abandon its application. The Virginia city wants to bind the new company to install a steam plant for emergency purposes at a cost of $60,000, in case of tie-up of the hydroelectric plant under construction on the Holston River; require it to give a $10,000 bond to begin delivering current within a year; to sell its franchise only with the city's consent, and to give the city the right to purchase the entire city equipment at any time at cost, less depreciation.

JACKSON, MISS.—The question of issuing $160,000 municipal light bonds will be submitted to the voters March 13. Address mayor.

SOMERVILLE, TEX.—The Somerville electric light plant has been sold to the Somerville Ice Company. The two plants will be combined under one management. J. D. Giddings is president and Aubrey Smith manager of the purchasing company.

WESTERN STATES.

CHINOOK, MONT.—The Montana Power Company, of Great Falls, Mont., is considering taking over the local electric light and water plant. Representatives of the company have been taking an inventory of the local establishment and have reported favorably in regard to its purchase. The stockholders of the local plant have offered it to the Montana company at actual cost, and should the company make the purchase, the lines carrying the current would be extended to Chinook, from Havre, and a day service added. Betterments and extensions to the local plant are also contemplated. O.

NOGALES, ARIZ.—E. J. Richards

will have charge of the construction of the building and the installation of the new electric plant of the International Gas Company.

ALBION, WASH.—The city council has appointed a committee consisting of Charles Huff, P. H. Matson, C. E. Calvert, Eugene Rice and C. E. Wright to draw plans for a lighting system. O. D. Crawford is mayor.

ELLENSBURG, WASH.—The city council has decided to install steam equipment in the municipal plant capable of developing 1,300 horsepower. Also a new concrete forebay, to reduce the danger incurred from ice. This improvement, it is estimated, will cost approximately $65,000. The council has also authorized the retaining of an expert hydraulic and electrical engineer to give advice in making the contemplated improvements, and to this end has petitioned the city of Seattle to loan the services of J. D. Ross, superintendent of lighting, Seattle, to consult with the city officials regarding the matter. O.

SEATTLE, WASH.—Mayor H. C. Gill has given qualified consent to the extension of the city lighting system to a small residence settlement just across the north city boundary, as the contracts were obtained for furnishing light before he became mayor. He has opposed, as has been reported, the extension of the lighting system outside the city limits, and when a bill passed the council for serving Tuckwila, Foster, Riverton, and other districts south of the city, he vetoed the measure. It is reported the north extension will be made shortly. O.

TOPPENISH, WASH.—The Pacific Power and Light Company plans considerable extension work locally and in the surrounding territory, according to G. I. Drennan, local manager.

BAKER, ORE.—This city has given up the idea of installing a municipal power plant to cost $180,000, upon the agreement of the Eastern Oregon Light and Power Company to reduce rates, and the proposed bond election will not be called.

TILLAMOOK, ORE.—J. R. Wheeler, of this city, will soon begin the construction of a lighting plant at Bar View.

SANTA ANA, CAL.—The board of trustees has decided not to pass on any more applications for street lights, but will leave the matter to the new board which will be elected in April.

PROPOSAL.

ELECTRICAL EQUIPMENT, NAVY DEPARTMENT.—Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until March 2, 1915, for furnishing the following electrical equipment: 4,000 feet interior communication cable; 3,000 searchlight carbons; 20 signal combination oil and electric lights; 10,000 feet twin wire conductor; as per schedule 7925, all for delivery at Navy Yard, Brooklyn, N. Y.

FOREIGN TRADE OPPORTUNITIES.

[Addresses may be obtained by writing (mentioning file numbers) to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or to the nearest of its branches at Boston, New York, Atlanta, Chicago, New Orleans, Seattle and San Francisco.]

NO. 15,571. ELECTRIC MOUNTAIN RAILWAY. An American consular officer in Norway reports that a firm in his district is inviting bids for the construction of an electric mountain railway. Plans and specifications are being forwarded and when these arrive they may be examined at the Bureau of Foreign and Domestic Commerce and its branch offices. It is explained that an American firm recently secured a contract for the installation of a new automatic telephone exchange for an important city in that district. The consular officer states that he is in a position to supply the names of capable local representatives in the event successful bidders require such services. Correspondence may be in English.

NO. 15,574. ELECTRIC LIGHTING APPARATUS, ETC. The Secretary of Commerce is in receipt of a communication from a business man in Spain, stating that he wishes to establish commercial relations with American firms manufacturing and exporting baskets, bazaar goods, lamps, and electric-lighting apparatus, and toys. He wishes these commodities to substitute for similar goods formerly imported from European countries.

NO. 15,582. MOTORS, ETC. A firm in Europe has informed an American consular officer that it wishes to import electrical goods, especially electric motors for driving machinery, etc. Correspondence and catalogs, etc., should be in Spanish.

FINANCIAL NOTES.

The Massachusetts Electric Company has decided to proceed at this time with the refunding of its $3,100,000 five-per-cent notes maturing May 1 next. For this purpose the road will issue $3,000,000 five-per-cent three-year notes to be dated April 1 next. The new notes, like the maturing obligations, will be a collateral issue and will be secured by deposit of a majority of the common stock of the Bay State Street Railway Company.

Directors of Mexican Northern Power Company have called a special meeting of bondholders for March 30 in Toronto to authorize the issue of the remaining $2,000,000 of the six-per-cent prior-lien 30-year bonds authorized in May, 1914. At that time an authorized issue of $3,000,000 of these bonds was created, of which $500,000 was sold. It is evident that an additional $500,000 has been sold since then. Because of the Mexican troubles the company deferred the interest on its $10,000,000 30-year 5-per-cent bonds.

Dividends.

	Term.	Rate.	Payable.
Am. Tel. & Cable	Q	1.25%	Mch. 1
Gen. Elec.	Q	$2	Apr. 15
No. Ohio Trac. & Lt.	Q	1.25%	Mch. 15
Phila. Elec.	Q	1.75%	Mch. 3

Reports of Earnings.

VIRGINIA RAILWAY & POWER.

	1914.	1913.
December gross	$ 443,650	$ 450,487
Net earnings	231,346	242,163
Total income	237,644	249,048
Surplus after charges	105,007	113,613
Balance after depreciation	96,673	105,280
Six months' gross	2,632,705	2,619,118
Net earnings	1,370,685	1,355,962
Total income	1,411,439	1,403,088
Surplus after charges	600,376	600,271
Balance after depreciation	550,376	550,271

NORTHERN OHIO TRACTION & LIGHT.

	1914.	1913.
December gross	$ 316,380	$ 295,377
Net after taxes	118,965	105,082
Surplus after charges	68,432	54,799
Balance after preferred dividends	51,710	39,635
Twelve months gross	3,636,084	3,284,532
Net after taxes	1,398,656	1,264,878
Surplus after charges	791,757	703,043
Preferred dividends	182,364	152,738
Common dividends	450,000	450,000
Balance	159,393	100,324

NORTHERN STATES POWER.

	1914	1913
December gross	$ 471,664	$ 417,537
Net after taxes	267,739	227,221
12 months' gross	4,505,246	4,058,142
Net after taxes	2,431,991	2,055,535
Surplus after charges	1,024,714	.....
Balance after preferred dividends	437,645	.....

PENNSYLVANIA WATER & POWER COMPANY.

The Pennsylvania Water & Power Company has issued its annual report for the year ended December 31, 1914:

	1914	1913
Gross	$1,009,373	$826,814
Net	855,552	709,767
Surplus after charges.	411,977	302,662

PACIFIC TELEPHONE.

The Pacific Telephone & Telegraph Company reports for the quarter ended December 31, 1914, compare as follows:

	1914	1913
Gross earnings	$4,890,107	$4,667,512
Net earnings	1,131,931	1,134,085
Interest	589,225	549,971
Net profits	$542,706	$584,114
Dividends	480,000	480,000
Surplus	$62,716	$104,114

WESTINGHOUSE ELECTRIC.

The Westinghouse Electric & Manufacturing Company reports to the New York Stock Exchange for the nine months ended December 31, 1914, as follows:

Sales billed	$26,278,076
Expenses, depreciation, etc.	24,627,925
Net manufacturing profit	$1,650,151
Other income	764,199
Total income	$2,414,350
Interest charges	1,060,184
Net income	$1,354,166
Previous surplus	7,741,708
Total surplus	$9,095,874
Preferred dividends	209,931
Common dividends	1,054,582
Miscellaneous adjustments	244,241
Profit and loss surplus	$7,587,118

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Feb. 15	Feb. 8
American Tel. & Tel. (New York)	120½	119⅞
Commonwealth Edison (Chicago)	136	136
Edison Electric Illuminating (Boston)	257	256
Electric Storage Battery common (Philadelphia)	48½	48
Electric Storage Battery preferred (Philadelphia)	48½	48
General Electric (New York)	142	141½
Kings County Electric (New York)	119	120
Massachusetts Electric common (Boston)	—	7
Massachusetts Electric preferred (Boston)	43½	—
National Carbon common (Chicago)	130	130
National Carbon preferred (Chicago)	—	119¾
New England Telephone (Boston)	136	136
Philadelphia Electric (Philadelphia)	23⅞	23⅝
Postal Telegraph and Cables common (New York)	73⅜	70
Postal Telegraph and Cables preferred (New York)	67	67
Western Union (New York)	63½	63¾
Westinghouse common (New York)	70½	70
Westinghouse preferred (New York)	117	117

PERSONAL MENTION.

MR. SAMUEL INSULL, president of the Commonwealth Edison Company, Chicago, Ill., returned to Chicago last week from a brief visit to London, Eng.

MR. ANGUS S. HIBBARD has been elected a director of the Chicago Telephone Company succeeding A. A. Sprague, deceased. Mr. Hibbard has also recently been elected a director of the Chicago Savings Bank & Trust Company.

MR. HARRIS HAMMOND, formerly vice-president, has been elected president of the Mt. Whitney Power and Electric Company. Mr. Ben S. Maddox has been elected first vice-president, and Mr. S. Mitchell has been elected second vice-president.

MR. G. O. WILSON has resigned as manager of the Dubuque Electric Company, Dubuque, Ia., and has been succeeded by Mr. H. C. Ault, of Rock Island. Mr. Ault is an experienced electrician and contractor, and has been associated with the leading manufacturers of the country for the past 12 years.

MR. E. P. BURCH, consulting electrical engineer of Minneapolis, Minn., has associated himself with Mr. Lester M. Sears for general consulting engineering practice. The new firm have opened offices on the twenty-third floor of the Dime Savings Bank Building, Detroit, Mich. Mr. Sears is to have charge of the Detroit office, and Mr. Burch will continue in charge of the Minneapolis office.

MR. H. H. CUDMORE, director of the Mazda bureau of the General Electric Company, who has been actively engaged in directing the exploitation of the trade-mark "Mazda" in San Francisco and central California territory during the past six months, returned to San Francisco recently from a trip to the home office of the General Electric Company. Mr. Cudmore announces that the activities of the Mazda bureau will be continued in the San Francisco territory and extended to Los Angeles and the surrounding territory, where a branch office of the bureau will be opened at 124 West Fourth Street, in the immediate future, with Mr. F. J. Blaschke in charge. The Mazda bureau will continue the exploitation of the trade-mark in the San Francisco and Los Angeles territories, also direct co-operative work among distributors of lamps bearing the Mazda mark, in which the bureau will be assisted by Mr. Clark Baker, who is assistant to Mr. J. A. Vandegrift, manager of the Oakland Mazda lamp division, National Lamp Works of General Electric Company, and representatives of the Edison Lamp Works of General Electric Company from the San Francisco and Los Angeles offices.

MR. H. J. HERBERTS, after an absence abroad of about 15 years, has returned to America to engage in the manufacture and sale of electrical specialties. Mr. Herbert began his technical career about 25 years ago with the Edison Electric Illuminating Company, of New York. He was employed in the early days in the old Edison Machine Works, and the subsequent works of the General Electric Company at Schenectady. His experience there included work in every department, particularly as it related to the testing of machinery of every description. He took part in the design and development of much of the early electrical apparatus. Later on he became assistant to D. MacFarlan Moore and foreman of the latter's laboratory, where he carried out tests and designs, perfecting the Moore system of vacuum tube lighting. In 1898 his method and means for detecting the approach of icebergs or of vessels at sea coming at the time of the *Burgogne* disaster attracted wide attention. He subsequently accepted an appointment with the Bergmann Works in Berlin as assistant to the chief engineer, and as foreman of the testing department. Later on he went to England where he held important positions with several of the larger manufacturing companies. Mr. Herbert will begin immediately the development of a company to handle a number of his recent inventions. He will also form a manufacturing and selling organization for the "Fortuna" Sales Producer, which will be of particular interest to the central-station managers. Mr. Herbert is a member of the Society for Electrical Development, with headquarters at 164 St. Nicholas Avenue, New York.

MR. A. B. SAURMAN, for the past 12 years Pacific Coast manager for the Standard Underground Cable Company, has been appointed southeastern manager of the company (succeeding the late Mr. T. E. Hughes) with headquarters in his native city, Philadelphia, Pa., and will return east in the early spring. He became associated with the company in Philadelphia, in 1893, and after two and one-half years in the construction department was transferred to the eastern sales department at New York City, leaving the position of assistant manager there in 1900, when he organized and was manager of the Northeastern sales department with headquarters at Boston, until transferred to San Francisco as manager of the company's interests there in the fall of 1902. Mr. Saurman has therefore been connected with the Standard Company for over 21 years, and during the period of the greatest growth and development of this well known company. He has long been prominently identified with electrical interests upon the entire Pacific Coast and has co-operated in the working out of many of the important problems of the past decade in connection with electrical distribution in that territory. John P. Bell, who will succeed Mr. Saurman as Pacific Coast manager of the Standard Underground Cable Company, entered the employ of the company at Pittsburgh, Pa., in 1896, where he has been located until transferred to the Pacific Coast. For the past eight years Mr. Bell has been the assistant secretary and treasurer of the company. Both Mr. Saurman and Mr. Bell began their business experience with the company in subordinate positions, and the fact that they owe their advancement to merit, compliments them as well as the company which thus evidences its belief in such a policy. Mr. R. M. Hirst and Mr. Edward Kershner will continue to be associated with Mr. Saurman, as formerly with the late Mr. Hughes, in the Philadelphia office territory, with headquarters at Philadelphia; Mr. S. S. Warner in like manner remaining unchanged at the Atlanta sub-office.

MR. WM. P. COCHRAN, formerly head of the industrial and power department of the Baltimore office of the Westinghouse Electric and Manufacturing Company, has been appointed branch manager of the Baltimore office, which has been consolidated with the Philadelphia office of the company. Mr. H. H. Seabrook, formerly manager of the Baltimore office, is now manager of the consolidated territory, with headquarters at Philadelphia. Mr. Cochran graduated from Pennsylvania State College in 1898 with degree of Bachelor of Science in Electrical Engineering. Upon leaving college he was appointed electrical assistant to the president of the Martic Water and Power Company at Wrightsville, Pa., which company later developed into the Pennsylvania Water and Power Company, and is now supplying electrical energy to the cities of Baltimore, Md., and Lancaster, Pa.; he retained this position until 1899, and then entered the testing department of the General Electric Company, in New York, where he was employed during 1899 and 1900. In 1901 he entered the employ of the Webster Coal & Coke Company as electrical engineer. From 1902 to 1904 Mr. Cochran was mechanical and electrical engineer, and assistant general superintendent of the Lackawanna Coal & Coke Company, succeeding from this position to that of master mechanic for the Pittsburgh-Buffalo Coal Company, at Cannonsburg, Pa., in 1905. In the fall of that year Mr. Cochran entered the employ of the Westinghouse Electric and Manufacturing Company, being located at Charleston, W. Va., where he remained until the fall of 1910, at which time he left the company and became general manager and treasurer of the Kanawha Fire Engine Company, of the same city. After two years he returned to the employ of the Westinghouse company and was assigned to the Baltimore office as manager of the industrial and power division, which position he retained until his appointment as branch manager as noted above. Mr. Cochran has been closely identified with industrial and power applications, particularly those of the coal-mining industry, and has a large circle of acquaintances in the electrical profession who will be glad to learn of his promotion.

OBITUARY.

MR. CHARLES C. HATFIELD, who, with his son, T. B. Hatfield, owned the Hatfield Electric Company, 36 South Meridian Street, Indianapolis, Ind., died suddenly on February 5 at his home, 1919 North New Jersey Street. Mr. Hatfield was born in Dayton, O., but had lived in Indianapolis since 1887, when he started the Hatfield Electric Company. He was a member of the Knights of Columbus, Jovian League and Indianapolis Chamber of Commerce. He is survived by a widow and three sons, T. M., John C. and Thomas S. Hatfield, all of Indianapolis.

MR. JAMES F. McELROY, inventor of electrical heating apparatus in common use in electric cars, and an author of note, died February 10 at Laconia, N. H., where he was on a business trip. Mr. McElroy was born in Greenfield, O., 62 years ago. He came east in 1872, entering Dartmouth College, where he graduated. For four years he was principal in the Indianapolis Institution for the Blind and after that was for seven years superintendent of the Michigan Institution for the Blind. He patented his inventions, and organized the McElroy Car Heating Company in 1887. Later it

was combined with the Sewall Car Heating Company. He organized the Consolidated Car Heating Company of Albany, N. Y., in which city he lived. Mr. McElroy was a frequent contributor to scientific magazines. He was a member of several clubs in Albany. He is survived by his wife, a son, John H. McElroy, of Albany, and a daughter, Mrs. William H. Gardner, of Chicago.

MR. J. C. STERNS, who died on January 31, was one of the most highly esteemed men in the electrical contracting fraternity. Mr. Sterns was born January 7, 1860, and started in the electrical contracting business as a partner in the firm of F. P. Jones Company in 1892. He continued in business with Mr. Jones for several years, finally buying him out and changing the name of the company to J. C. Sterns Electrical Company. As such it was continued up to the time of his death. Mr. Sterns was one of the pioneer electrical contractors of the city of Buffalo, and was one of the first contractors to install the new system of electrical wiring, placing wires in iron conduits in some of the largest buildings in Buffalo. He was a hard worker, honest and industrious, and enjoyed a remarkable reputation as a fair and honorable competitor. He was a charter member of the National Electrical Contractors' Association, and at the time of his death was sergeant-at-arms of this association. The business will be continued by his two

J. C. Sterns.

sons, L. E. and Selden S., and Mr. J. T. Arrundell.

DATES AHEAD.

American Physical Society. Columbia University, New York City, February 27. Secretary, A. D. Cole, Columbus, O.

"Made in the U. S. A." Industrial Exposition. Grand Central Palace, New York City, March 6-13. President, H. A. Cochrane, Fifth Avenue Building, New York, N. Y.

New England Section, National Electric Light Association. Question Box convention, City Club, Boston, Mass., March 9-10. Secretary, Miss O. A. Bursiel, Boston, Mass.

Electrical Supply Jobbers' Association. Spring meeting, Hotel La Salle, Chicago, Ill., March 17-19. Secretary, Franklin Overbagh, 411 South Clinton Street, Chicago, Ill.

American Institute of Electrical Engineers. Industrial Power meetings, Cleveland, O., March 18-19; Pittsburgh, Pa., April 15-16. Secretary, F. L. Hutchinson, 33 West Thirty-ninth Street, New York, N. Y.

Minnesota Electric Association. Annual meeting, St. Paul, Minn., March 23-25. Secretary, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn.

National Association of Electrical Inspectors. Annual convention, Hotel Martinique, New York City, March 23-25. Secretary, W. L. Smith, Concord, Mass.

Electrical Committee, National Fire Protection Association. Meeting, New York City, March 24-25. Secretary, Ralph Sweetland, 141 Milk Street, Boston, Mass.

National Electric Light Association. Annual convention, San Francisco, Cal., June 7-11. Secretary, T. C. Martin, 29 West Thirty-ninth Street, New York, N. Y.

With the Electrical Manufacturers

Electrical Engineers Equipment Company, 711-715 Meridian Street, Chicago, Ill., has issued bulletin No. 104 devoted to busbar clamps, cable racks, floor air boxes, insulating compound, malleable pipe and switchboard fittings.

Kerr Turbine Company, Wellsville, N. Y., has appointed W. E. Storey as its Toronto, Canada, representative, with offices in the Kent Building. Mr. Storey was formerly identified with the Underfeed Stoker Company, and more recently with the Goulds Manufacturing Company.

The Electrical Alloy Company, Morristown, N. J., announces the opening of offices at 30 Church Street, New York; the Bourse, Philadelphia, Pa., and the Equitable Building, Baltimore, Md., in charge of E. O. Oeters, who has been appointed the company's eastern representative.

The Despatch Manufacturing Company, 104 North Second Street, Minneapolis, Minn., is desirous of arranging for representatives and selling agents to handle its portable electric room heaters, attachable to electric light sockets, as well as its electric ovens and other electrically heated appliances.

American Manufacturers' Agency, Incorporated, 111 West Monroe Street, Chicago, Ill., has become selling agency for the line of switches, panelboards, etc., made by the Trio Manufacturing Company, Rock Island, Ill. Another line taken over is the agency for the "P. J. Lightning Toaster," which was described in our issue of February 6, 1915.

The Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, Pa., has issued an illustrated book descriptive of the Macbeth Illuminometer. This shows many views of the instrument, diagrams of its arrangement, test-plate curves, etc. The operation of the instrument and its construction are explained in detail. This instrument was described in our issue of January 30, 1915.

The Chelten Electric Company, 314 Armat Street, Philadelphia, Pa., has recently appointed W. G. Williams, formerly of the Stuart-Howland Company, and now located in Baltimore, as its agent to cover the states of Maryland, North Carolina and the greater part of Virginia. The Chelten Electric Company also announces that it expects shortly to have ready for the trade a full line of inclosed fuses of the ferrule type.

General Lead Batteries Company, Newark, N. J., announces that, due to the existence of a battery jar marketed under the name "Titan" and the fact that any battery using these jars might appear as a Titan battery, the Titan Storage Battery Company, of Newark, has changed its name to the General Lead Batteries Company. No change whatever in ownership, officers or policy is involved. The change is made entirely to avoid confusion.

The Beck Electrical Construction Company has changed its office address from 204 Andrus Building to 1139-40 Plymouth Building, Minneapolis, Minn. The shop address has been changed from 229 Central Avenue to the subbasement of the Plymouth Building. This new arrangement enables the company to have its shop in the same building with its office, thereby facilitating the handling of work and improving upon its already prompt and efficient services.

Usona Manufacturingg Company, Incorporated, has been granted charters under the laws of the states of New York and Ohio, with eastern offices at 1 Hudson Street, New York City, and western offices at 1012 Monroe Street, Toledo, O., for the purpose of manufacturing and selling flashlight cases, batteries, lamps, and battery lanterns. The incorporators of the New York company are George G. Beers, Frank Stout and William Carell, all of New York City.

Dale Lighting Fixture Company, Incorporated, 107 West Thirteenth Street, New York City, has issued a booklet on "Lighting Commercial

Buildings." It describes particularly the Dale Broadway lighting unit readily convertible from a direct to a semi-direct or indirect fixture by applying simple attachments. This equipment is an efficient and simple outfit designed to meet the lighting requirements of commercial buildings. Over 13,000 of these Dale units were installed in the new Equitable Building in New York City.

The Page & Hill Company, Minneapolis, Minn., has compiled a file containing information on cedar poles, butt treatment and wood preservatives. This file goes to the customers of the company in a heavy binder made to fit any standard vertical letter-file cabinet. The valuable information in this file should be carefully preserved, as it will be kept up to date through renewals by the company. Some of the classifications in the file are as follows: Curves, comparative life; information about preservatives; butt treatment; cedar poles; specifications for Western Red Cedar poles; specifications for Northern White Cedar poles; specifications for butt treatment. The system may be extended indefinitely, and should prove to be a very valuable addition to the business literature of any organization interested in the distribution or utilization of poles.

Westinghouse Electric & Manufacturing Company announces the removal of the offices of its newly organized Automobile Equipment Department from East Pittsburgh to Shadyside Station, Pittsburgh, Pa., where they will be located in the works devoted exclusively to the manufacture of Westinghouse automobile equipments. This department was organized on January 1, with G. Brewer Griffin as manager in charge, and takes the place of that formerly known as the Automobile Equipment Division of the Detail and Supply Department. The Westinghouse company reports that the business in automobile equipments has been very satisfactory, thus making it desirable to concentrate the sales and works departments at one point. In addition to the new headquarters, service stations have been established in New York, Chicago, Indianapolis, Cleveland and Detroit.

The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has issued a very unique book entitled "Gear Shifting by Electricity." This book is devoted to the Vulcan electric gear shift, which is applied to the sliding-gear transmission of gasoline motor cars so as to accomplish the change of gears with extraordinary simplicity and convenience. The sliding-gear transmission of a gas car is first explained in a very clear and logical manner. The principle of the electromagnet is then taken up and the manner in which this can be used for accomplishing gear shifting is set forth. The principle and construction of the Vulcan electric gear shift is then described and its manner of operation is explained. The advantages of this method of shifting gears are set forth. Throughout the book is an exceedingly large number of fine illustrations, both to elucidate the text in its preliminary discussion of principles and in its detailed description of the Vulcan outfit. A large number of full-page plates are employed. There are also many clever marginal sketches which add interest to this fine publication. The most valuable feature of the Vulcan electric gear shift is in mounting the control buttons on the steering post, where they are immediately accessible without removing the hands from the wheel or the eyes from the road, thus making it possible for even a timid person to have always complete control of a gas car.

Record of Electrical Patents.

Issued by the United States Patent Office, February 9, 1915.

1,127,383. Electrical Fixtures and Their Attachment to Conduits. C. W. Abbott and H. R. Gilson, assignors to National Metal Molding Co., Pittsburgh, Pa. Receptacle for fitting onto metal molding. (See cut.)

1,127,390. Spark Plug for Internal-Combustion Engines. E. Bauer, assignor to the firm of Robert Bosch, Stuttgart, Germany. One electrode has a flat sparking part of small mass so as to become incandescent at ignition and thereby consume residues deposited thereon.

1,127,405. Telephone System. E. H. Clark, assignor to Western Electric Co. Trunking system with selecting switches automatically moved in unison at each end of the trunks.

1,127,408. Electric Switch. R. C. Cole, assignor to Johns-Pratt Co., Hartford, Conn. Inclosed spring plunger and cutout switch controlled by push-buttons on removable cover.

1,127,414. Dynamo-Electric Machine. W. W. Dean, assignor to Garford Mfg. Co., Elyria, O. Rotary distributing switch on magneto.

1,127,424. Thermopile. P. Ferra, Caluire-et-Cuire, France. Comprises a brass cell and a packing of composite material containing sulphur, kaolin and copper sulphide.

1,127,425. Electric Welding Machine. S. B. Field, assignor of one-fourth to Pneumatic Scale Corporation and three-fourths to W. H. Doble, Quincy, Mass. Includes a rotary welding roll having a number of contact points projecting therefrom.

1,127,427. Controlling Mechanism for Electric Automobiles. O. P. Fritchle, assignor to Fritchle Automobile & Battery Co., Denver, Colo. Control lever must be brought to "off" position before reversing.

1,127,436. Dynamic Return Indication Signal. W. S. Henry, assignor to General Railway Signal Co., Gates, N. Y. Semaphor mechanism biased to danger and motor-operated to clear position.

1,127,437. Universal Cord Circuit. J. E. Hilbish, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. For interconnecting magneto and common-battery telephone lines.

1,127,438. Railway Signaling. J. S. Holliday, assignor to Union Switch & Signal Co., Swissvale, Pa. Impedence device controlling an oscillating member through changes in frequency.

1,127,442. Electrical Switch. B. D. Horton, Detroit, Mich. Ironclad service switch with spring quick-break mechanism.

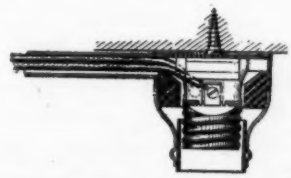
1,127,453. Device for Automatically Lowering the Trolley-Pole of Electrically-Driven Vehicles. C. Ködderitzsch, Dortmund, Germany. Spring-actuated retriever.

1,127,464. Electric Regenerative Motor and System of Control. R. Lundell, New York, N. Y. Separately excited motor with single distributed field winding and external means for changing the characteristic of the motor to resemble a shunt, compound or series motor.

1,127,466. Selective Controlling Apparatus. F. R. McBerty, assignor to Western Electric Co. Selector controlled by interrupter, self-locking relays and special switches.

1,127,467. Telephone-Exchange System. F. R. McBerty, assignor to Western Electric Co. Semi-automatic system with selector for sending call over direct trunk or overflow trunk.

1,127,470. Electric Railway. C. B. McLeer and J. F. McLeer, assignors to Elec-



No. 1,127,383.—Metal-Molding Receptacle.

tric Carrier Co., Wilmington, Del. Stator elements of the motor mechanism are mounted along opposite sides of the track and the movable motor element is mounted on the car.

1,127,474. Insulator Support. G. Mardock, Illinois City, Ill. Insulator slips over and is bolted through conical pin to bracket or crossarm.

1,127,475. Electric Furnace. J. G. Marshall, assignor to Union Carbide Co., Niagara Falls, N. Y. Special connection between transformer and electrodes.

1,127,499. Electrode. C. E. Osmer and J. B. Roach, Beardstown, Ill. Has one extremity offset and to serve as a securing means.

1,127,513. Paper Condenser. A. Pruessman, assignor to Western Electric Co. The filler around the unit is a compound consisting of 80% asphaltic cement, 8% rosin and 12% Montan wax.

1,127,526. Electric Heater. G. J. Schneider, assignor to Acme Electric Heater Co., Detroit, Mich. Detachable armored resistance element for flatiron.

1,127,527. Lighting Fixture. A. Schoen, assignor to Superior Brass & Fixture Co., Chicago, Ill. Semi-direct fixture with spider-like suspension and socket-supporting framework connected with metal rim of bowl.

1,127,540. Regulating Apparatus for Drying Sheets of Paper, Cloth and the Like. C. Stickle, Indianapolis, Ind. Electrothermostatic steam regulator.

1,127,554. Therapeutic Electric Apparatus. R. H. Wappler, assignor to Wappler Electric Mfg. Co., New York, N. Y. Special induction arrangement with rotating primary coil.

1,127,558. Carbon-Holder. W. W. Wile, Bluffton, Ind. Cam terminal clamp.

1,127,563 and 1,127,564. Dynamo-Electric Machine. G. Winter, deceased, by O. Wolfrum, administrator, Vienna, Austria-Hungary and F. Eichberg, Berlin, Germany. Commutator machine with rotor and stator windings adapted to magnetize the machine in one direction and means for creating a variable magnetization at an angle to the first and in phase with the rotor working current.

1,127,573. Multiple-Switch Controller. P. H. Zimmer, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. The switch members are loosely mounted upon the spindle, but are progressively connected thereto upon successive oscillations.

1,127,578. Arc-Lamp Electrode. A. T. Baldwin, assignor to National Carbon Co., Cleveland, O. Flame-arc carbon includes cerium oxide, zirconion oxide and tungsten oxide.

1,127,593. Railway-Traffic-Controlling Apparatus. J. P. Coleman, assignor to Union Switch & Signal Co. Electrically controlled switches and signals for railway crossover.

1,127,616. Mechanism for Making Armored Cable. H. R. Gilson, assignor to National Metal Molding Co. Includes a gradually tapered mandrel and a means for coiling a metallic strip upon its tapered part and upon the cable.

1,127,618. Indicator. A. R. Hartmann, Houston, Tex. Speed indicator with electric signals.

1,127,631. Switch. S. N. Jordan, Lowell, Mass. Double-throw switch.

1,127,655. Electric Flasher for Multiple Sets of Lamps. E. C. Lorenz, assignor to Pacific Motorless Sign Co., San Francisco, Cal. Flashing and dimming apparatus includes an arched expansible conductor

carrying an insulated resistance coil wound around it for each set of lamps.

1,127,665. Electric Needle. G. H. Murphy, Redding, Cal. The point is formed of a single piece of resistance metal bent upon itself to form spaced pen-shaped parts.

1,127,696. Lightning-Rod Low Top. J. S. Swenson, assignor to Electra Lightning Rod Co., Cresco, Iowa. Pointed tube has lower portion split and spread apart to afford brace and fastening means at connection to lightning conductor.

1,127,707. Shallow-Draft Submarine Boat. F. B. Whitney, Waukegan, Ill. Engines and dynamos mounted in tandem on the keel-plate and storage batteries fore and aft.

1,127,738. Tuning Device for Wireless-Telegraph Systems. A. J. Coughenour, Fort Leavenworth, Kans. Variable inductance including nested coils and means for connecting any number thereof in circuit.

1,127,741. Process for Making Terminal Banks. A. F. Dixon, assignor to Western Electric Co. Consists in superposing flexible insulating sheets coated with plastic insulating compound and metal strips and there subjecting the pile to pressure.

1,127,761. Electric Signaling Apparatus and Circuits. F. B. Herzog, New York, N. Y.; H. Herzog, executrix of said F. B. Herzog, deceased. Transmitting instrument with indicator controls the receiving instrument or signal step by step through current impulses.

1,127,775. Automatic Make-and-Break Device for Projecting-Machines. L. R. Kennedy and O. B. Olson, Denver, Colo., assignors to O. K. Controller Co. Rupture of film in motion-picture machine breaks lamp and motor circuits.

1,127,776. Insulator. C. W. Kettron, assignor to Illinois Electric Porcelain Co., Macomb, Ill. Porcelain knob with reversible sections having stepped engaging surfaces.

1,127,779. Electric Switch. C. J. Klein, Milwaukee, Wis. Operated by reciprocating push-bar.

1,127,792. Receipting Device. G. L. Mather, Akron, O. Electrically operated printing and card-shearing device.

1,127,805. Ignition Timer for Gas Engines. J. T. Pedersen, Flushing, N. Y. Details of construction.

1,127,808. Sequence Switch. J. N. Reynolds and C. F. Baldwin, assignors to Western Electric Co. Telephone switch with several rotary disks on a common shaft, the contacts of both sides of the disks engaging stationary terminals.

1,127,827. Ignition System. B. P. Swyers, Pittsburgh, Pa., assignor of three-fourths to G. E. Lorch, M. Maul, L. Lorch, Jr., J. H. Wagner, G. M. Davis. Special switch for short-circuiting magneto while battery is in use.

1,127,839. Portable Battery-Light. L. A. Williamson, New York, N. Y. Socket, lamp, reflector and switch mounted on top of cell.

1,127,855. Telegraph Key. J. N. Bell, Oneida, N. Y. Details.

1,127,856. Pocket Lamp. O. A. Boehm, New York, N. Y. Lamp mounted above cell, but within inclosure.

1,127,864. Trolley Switch. W. R. Daggett, Seattle, Wash., assignor of one-third to S. N. Lasher. Automatic trolley guide switch with shiftable switch points.

1,127,876. Selective Signaling System. J. C. Field, assignor to Western Electric Co. For telephone train dispatching.

1,127,889. Telephone-Exchange Apparatus. E. E. Hinrichsen, assignor to Western Electric Co. Apparatus for ringing the substations from the exchange.

1,127,897. Method of Therapeutic Treatment and Apparatus Therefor. J. H. Kellogg, Battle Creek, Mich. Medicated inhaling outfit; breathing apparatus is positively charged and couch for patient is negatively charged.

1,127,903. Combined Electric Incandescent Lamp and Reflector. C. P. Lawson, Brocton, N. Y. Upper part of bulb is petticoat-shaped and has external reflecting coating. (See cut.)

1,127,916. Burglar-Alarm. T. H. Nelson, Chicago, Ill. Special circuit-closing arrangement.

1,127,921. Apparatus for Radio Communication. G. W. Pickard, assignor to Wireless Specialty Apparatus Co., Boston, Mass. Means for tuning by inductance variation the high-frequency oscillation circuit of the receiving station.

1,127,935. Terminal Connection. A. H. Snyder, Lancaster, N. Y., assignor to Gould Storage Battery Co. Protective covering for storage-battery terminal.

1,127,936. Storage-Battery Cell. A. H. Snyder, assignor to Gould Storage Battery Co. Special sealing arrangement on cover.

1,127,948. Cystoscope. R. H. Wappler, New York, N. Y. Electric lamp at anterior end of instrument.

1,127,966. Deposition of Iron. S. O. Cowper-Coles, London, England. Consists in adding iron sponge to the electrolyte and distributing it by agitation.

1,127,973. Handle-Switch. J. Elia, Chicago, Ill. Operated by protruding button.

1,127,996. Electric Switch. P. V. Hunter, Newcastle-upon-Tyne, England. Terminals arranged to extinguish arc and prevent short-circuit.

1,128,005. Adjustable-Speed Control for Electric Motors. A. Kimble and J. D. Nies, assignors to Kimble Electric Co., Chicago, Ill. Resistance-varying contact controlled by governor.

1,128,006. Alternating-Current Indicator. C. Krämer and J. Krell, assignors to General Electric Co. Cylindrical body carrying pointer moves in shifting field.

1,128,013. Signaling-Instrument Set. M. Levison, assignor to Chicago Signal Co., Chicago, Ill. Has pendent switch attached to wall box that contains relay.

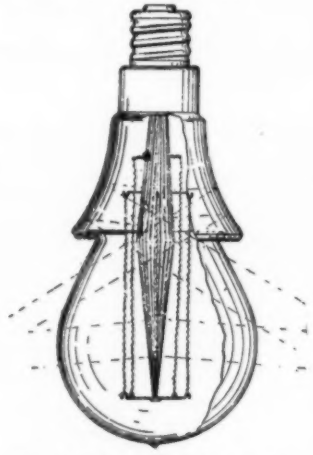
1,128,019. Telephone-Call Recorder. D. J. McGauran, Geraldton, W. A., Australia. Time-controlled recorder registers if called party answers within allowed time limit.

1,128,036. Electric Implement. L. Paulero, Petersburg, Va. Has solenoid-reciprocated plunger.

1,128,057. Block-Signal System for Electric Railways. F. W. Sawyer, assignor to Union Switch & Signal Co. Alternating-current system controlled by changes in the power-factor of the currents in the track rails.

1,128,066. Signal for Automobiles and Other Vehicles. E. C. Shuler and S. Cohen, Dover, N. J. Electric lamp signal.

1,128,070. Vapor Electric Device. R. G. Standerwick, assignor to General Electric Co. High-pressure mercury-vapor quartz lamp with regulating resistance.



No. 1,127,903.—Reflector Lamp.

1,128,075. Signaling System. J. B. Struble, assignor to Union Switch & Signal Co. A. C. Block signaling on D. C. railway.

1,128,081. Electric Heating Device. M. Vogel, assignor to General Electric Co. For use in matrix drying.

1,128,102. Electrically Heated Soldering-Iron. L. W. Campbell, South Yarra, Vic., Australia. Relates to arrangement of heating elements in head.

1,128,106. Electrical-Conduit Attachment. A. McMurtrie and L. H. Church, assignors to Thomas & Betts Co., New York, N. Y. Attached to outlet box is special gripping device for armor sheath.

1,128,116. Metallic Electric Welder. W. H. Dralle, Schenectady, N. Y. For welding tubes into boiler heads, etc.,

1,128,120. Machine for Manipulating Glass Rods and Forming Spiders Therewith. J. T. Fagan, assignor to General Electric Co. For making holders for metal lamp filaments.

1,128,126. Signal System. G. Furrer, Oakland, Cal. Contactor set with contact groups for tens and units, a motor-driven switch blade and electromagnetic switches.

1,128,141. Electric Fire-Alarm. W. E. Howells, Peckville, Pa. Thermostatic circuit-closer.

1,128,163. Automatic Electric Heating System. J. F. McElroy, assignor to Consolidated Car-Heating Co. Heaters are electropneumatically controlled by thermostat.

1,128,167. Circuit-Controller. E. Manson, Sagamore, Mass. Special switch for battery and lamp.

1,128,171. Automatic Stop for Talking Machines. R. O. May, Salem, Ind. Electromagnetically operated brake.

1,128,210. Signaling System. G. Witty, Scranton, Pa., assignor of one-half to S. S. Spruks. Antenna comprises a concave reflector section, a concave metallic backing capable of collecting magnetic waves and a lamp in the focus of the concave reflector.

1,128,229. Method and Apparatus for Generating Electricity. D. F. Comstock, Brookline, Mass. Method of producing current directly from heat consists in heating a substance so that it emits charged ions, and absorbing the ions by a substance maintained at a lower temperature.

1,128,232. Storage-Battery-Separator Construction. J. N. Davis, Denver, Colo. Non-perforated absorbent envelope completely surrounds the plate.

1,128,261. Lightning-Rod High Top. J. S. Swenson, assignor to Electra Lightning Rod Co., Cresco, Iowa. Modification of No. 1, 127,696; provides lateral braces for projecting rod.

1,128,262. Telephone System. H. S. Turner, San Diego, Cal. Removing receiver from hook throws pulsating current onto lamp signal at board and onto calling receiver, showing line to be O. K.; when operator cuts off this current, cessation of audible signal in receiver shows she is ready for number.

1,128,270. Dynamo-Electric Generator. G. Inrig and L. Inrig, assignors to R. L. Hubler and G. S. Greene, Dayton, O. Has rocker reversing brushes to maintain constant polarity.

1,128,275. Storage Battery. A. H. Snyder, assignor to Gould Storage Battery Co. Cover for cell has electrolyte catch-basin and special vents.

Reissue 13,878. Current-Generator and Igniter for Internal-Combustion Engines. E. Podlesak, Tiffin, O. Original No. 1,055,076, dated March 4, 1913. Make-and-break igniter.

Patents Expired.

The following United States electrical patents expired February 15, 1915:

598,905. Apparatus for Electrically Measuring Temperatures. H. L. Callendar, Montreal, Canada.

598,922. Automatic Cutout for Electrical Converters. W. J. Greene, Cedar Rapids, Iowa.

598,926. Box or Case for Secondary-Battery Electrodes. G. W. Harris and R. J. Holland, New York, N. Y.

598,937. Trolley. C. H. Johnson, Elmhurst, Cal.

598,942 and 598,943. Electric Arc Lamp. G. R. Lean, Cleveland, O.

598,946. Direct-Acting Oscillating Electric Motor. J. H. Mason, Brooklyn, N. Y.

598,947. Track Bond for Electric Railways. F. T. Mather, Detroit, Mich.

598,948. Electric Battery for Medical Purposes. C. W. Moessner, Philadelphia, Pa.

598,972. Tip for Electric Conductors. A. B. Blodgett, Lowell, Mass.

598,991. Controller for Electric Motors. E. W. G. C. Hoffman, Charlottenburg, Germany.

599,002. Incandescent Lamps. J. T. Lister, Cleveland, O.

599,015. Electric Elevator. H. Rowntree, Chicago, Ill.

599,019. Automatic Railway Gate. J. F. Small, Chicago, Ill.

599,032. Electric Arc Lamp. C. N. Black, New Haven, Conn.

599,046. Electric Meter. C. Raab, Kaiserslautern, Germany.

599,081. Insulated Joint for Railroad Rails. T. O'Brien, Jr., Philadelphia, Pa.

599,094. Transforming Potential Energy of Carbon into Electrical Energy. H. Blumenberg, New York, N. Y.

599,121. Electric Gas-Lighting Apparatus. W. E. Cram and J. H. L. Clegg, Boston, Mass.

599,162. Electric System of Propulsion. W. M. Brown, Johnstown, Pa.

599,186. Electric Controller. F. A. Merrick, Auburndale, Mass.

599,220. Electric Alarm Water Column. M. L. Bush, Lawrence, Mass.

599,274. Trolley Pole for Overhead Electric Railways. J. L. Walker, Louisville, Ky.

599,292. Underground Conduit for Electric wires. A. L. Daniels, North East, Pa.

599,302. Direct-Current Meters. G. A Scheefer, Peoria, Ill.

599,304. Demagnetizing Device. H. A. Storrs, Burlington, Vt.

599,305. Electric Arc Lamp. C. Tepel, Bennett, Pa.

599,306. Making Filaments for Electric Lighting. D. C. Voss, Boston, Mass.

599,307. Trolley-Actuated Switch-Operating Device for Electric Railways. L. E. Walkins, Springfield, Mass.